REPORT RESUMES

ED 013 894 VT 001 214

AGRICULTURAL CHEMICALS TECHNOLOGY, A SUGGESTED TWO-YEAR POST HIGH SCHOOL CURRICULUM AND COURSE OUTLINES.

BY- HALTERMAN, JERRY AND OTHERS

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PUB DATE DEC 65

EDRS PRICE MF-$0.75 HC-$6.04 151P.

DESCRIPTORS- *CURRICULUM GUIDES, CURRICULUM, *AGRICULTURAL EDUCATION, POST SECONDARY EDUCATION, *AGRICULTURAL CHEMICAL OCCUPATIONS, *AGRICULTURAL TECHNICIANS, BIBLIOGRAPHIES,

DATA REVEALED BY STUDIES OF AGRICULTURAL BUSINESS TRAINING NEEDS CONDUCTED IN SEVERAL STATES PROMPTED THE DESIGN OF AN INSTRUCTIONAL MATERIALS SERIES TO ASSIST STATE AND LOCAL VOCATIONAL EDUCATION LEADERS IN DEVELOPING PROGRAMS TO PREPARE YOUTH AND ADULTS FOR EMPLOYMENT AND ADVANCEMENT IN OFF-FARM AGRICULTURAL OCCUPATIONS. THIS DOCUMENT, THE INTRODUCTION TO THE SERIES ON AGRICULTURAL CHEMICALS, WAS DEVELOPED BY A TASK FORCE OF SPECIALISTS TO ASSIST IN THE DEVELOPMENT OF A 2-YEAR POST-SECONDARY CURRICULUM FOR PREPARING TECHNICIANS TO SERVE AS AGRICULTURAL CHEMICAL PRODUCT SALESMEN AND SERVICEMEN, EQUIPMENT SALESMEN AND SERVICEMEN, PRODUCTION AND CONTROL TECHNICIANS, TECHNICIANS, SPECIALISTS, APPLICATORS, AND FARM MANAGEMENT CONSULTANTS. IT INCLUDES AN INTRODUCTORY STATEMENT, A DESCRIPTION OF THE NATURE OF THE PROGRAM, AN OVERVIEW OF THE CURRICULUM, AND A SUGGESTED CURRICULUM. COURSES ARE CLASSIFIED AS GENERAL, SUPPORTING TECHNICAL, AND TECHNICAL SPECIALITY. OUTLINES ARE INCLUDED FOR THREE COURSES IN COMMUNICATIONS, FOUR IN CHEMISTRY, TWO IN MECHANICS, SEVEN IN AGRICULTURAL BUSINESS, THREE IN BIOLOGICAL SCIENCES, SEVEN IN AGRICULTURAL SCIENCE AND PRODUCTION, AND TWO IN PERSONAL DEVELOPMENT. STUDY GUIDES IN EIGHT TECHNICAL SPECIALTY COURSES ARE PRESENTED AS SUBSEQUENT UNITS IN THE SERIES. A 95-ITEM BIBLIOGRAPHY IS INCLUDED. TWELVE GUIDELINES FOR THE DEVELOPMENT OF TRAINING PROGRAMS FOR AGRICULTURAL TECHNICIANS ARE OUTLINED, AND EDUCATIONAL NEEDS FOR AGRICULTURAL TECHNICIANS AND AGRICULTURAL CHEMICALS TECHNICIANS ARE LISTED. THIS DOCUMENT IS AVAILABLE FOR A LIMITED PERIOD FOR $6.75 PER SET (VT 001 214 - 001 222) FROM THE CENTER FOR VOCATIONAL AND TECHNICAL EDUCATION, THE OHIO STATE UNIVERSITY, 980 KINNEAR ROAD, COLUMBUS, OHIO 43212. (JM)

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ED013894

A SUGGESTED TWO-YEAR POST HIGH SCHOOL CURRICULUM AND COURSE OUTLINES

AGRICULTURAL CHEMICALS TECHNOLOGY

The Center for Research and Leadership Development

in Vocational and Technical Education

The Ohio State University
980 Kinnear Road
Columbus, Ohio 43212

The development of these materials was supported by a grant
from the
Division of Adult and Vocational Research
United States Office of Education

December, 1965

VT001214

MEMORANDUM

TO: The ERIC Clearinghouse on Vocational and Technical Education
The Ohio State University
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FROM: (Person) James W. Hensel (Agency) The Center for Vocational and Technical Education

(Address) 980 Kinnear Road, Columbus, Ohio 43212

DATE: August 7, 1967

RE: (Author, Title, Publisher, Date) "A Suggested Two-Year Post High School Curriculum and Course Outline - Agricultural Chemicals Technology," The Center for Vocational and Technical Education, December, 1965.

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(2) Means Used to Develop Material:
Development Group National Task Force
Level of Group National
Method of Design, Testing, and Trial Part of a funded project of the USOE, OE-5-85-009; materials based on research from state studies; see preface materials in the course outline.

(3) Utilization of Material:
Appropriate School Setting Post High School
Type of Program Intensive, full-time, two-year, technician program
Occupational Focus Goal in the Agricultural Chemicals Industry
Geographic Adaptability Nationwide
Uses of Material Instructor course planning
Users of Material Teachers

(4) Requirements for Using Material:
Teacher Competency Background in agricultural chemicals
Student Selection Criteria Post high school level, aptitude in chemistry, high school prerequisite, goal in the agricultural chemicals industry.
Time Allotment Estimated time listed in module. (P)

Supplemental Media --
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This publication is a portion of the course material written in Agricultural Chemicals Technology. To be understood fully, the complete set of materials should be considered in context. It is recommended that the following order be observed for a logical teaching sequence:

#1 - The Use of Chemicals as Fertilizers

#2 - The Use of Chemicals as Insecticides - Plants

#3 - The Use of Chemicals as Soil Additives

#4 - The Use of Chemicals as Fungicides, Bactericides and Nematocides

#5 - The Use of Chemicals to Control Field Rodents and Other Predators

#6 - The Use of Chemicals as Herbicides

#7 - The Use of Chemicals in the Field of Farm Animal Health (Nutrition, Entomology, Pathology)

#8 - The Use of Chemicals as Plant Regulators

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AGRICULTURAL CHEMICALS TECHNOLOGY

A SUGGESTED TWO-YEAR
POST HIGH SCHOOL
CURRICULUM
and
COURSE OUTLINE

THE CENTER FOR RESEARCH AND LEADERSHIP DEVELOPMENT
IN VOCATIONAL AND TECHNICAL EDUCATION
THE OHIO STATE UNIVERSITY

Robert E. Taylor.	Director of The Center
Jerry J. Halterman.	Director - Agricultural Chemicals Technology Study

PREFACE

This publication is one of a series developed by a national task force at The Center for Vocational and Technical Education to assist state and local vocational education leaders in developing programs to prepare youth and adults for employment and/or advancement in off-farm agricultural occupations.

One of the rapidly expanding areas of employment is that of "middle manpower"--the technician. And the agricultural community is no exception. This publication is in recognition of the need for the development of instructional programs for the post-high school agricultural technicians.

This project had its origin in the National Research Coordination Conferences on Off-farm Agricultural Occupations sponsored by The National Center for Advanced Study and Research in Agricultural Education and the Agricultural Education Branch of the U. S. Office of Education in May of 1963 and January of 1964. These conferences were designed to assist states in undertaking studies of off-farm agricultural occupations training needs.

Subsequently, The Center was given a grant by the Bureau of Adult and Vocational Research to synthesize these studies, develop needed instructional and program materials, and conduct training conferences on their use.

The task force of thirty people from sixteen states has included personnel with a wide range of backgrounds and responsibilities in agricultural education, vocational education, agricultural technology, and agricultural industry. Several project advisory meetings were held to secure needed counsel from diverse, but relevant groups and to help the task force maximize the potential benefits and uses of these materials.

Primary leadership for the development of this publication series was provided by Dr. Jerry Halterman, Dean of Agriculture, Chico State College, Chico, California. Others assisting him on the project are listed in the "Acknowledgements."

In developing these instructional materials, prime consideration was given to the data revealed by the studies of agricultural business and employee training needs conducted in several states. Current and projected employment opportunities dictated the areas in which instructional materials were developed. In addition, these studies identified those occupations which require knowledge and skill in agriculture. They also contributed to the development of the publication series through the identification of specific competencies needed by individuals for entry and persistence in agricultural occupations.

Members of the task force were aided in the development of these publications through personal visitations to outstanding existing agricultural technician programs. Frequent consultations with trade association educational committees and agricultural industry leaders concerned with personnel development were helpful in further "keying" these materials to employment needs. Existing materials were carefully reviewed and evaluated in terms of their utility in the preparation of these workers and, when suitable, were recommended as a part of these publications. References are also made to other instructional materials and sources designed to aid teachers and supplement and reinforce project materials.

Following the first draft of each publication by The Center, copies were sent to a wide range of knowledgeable individuals for review and evaluation. Reviewers included experienced teachers in vocational agriculture and other vocational services, college and university specialists in the appropriate subject-matter area, supervisory and research personnel, and agricultural business and industrial leaders. Many of their comments and suggestions were incorporated into the revision. However, the final responsibility for the content rests with the project staff.

It should be recognized that these materials are still developmental in nature. Although considerable time and effort have been expended to bring them to this stage of development, it is recognized that they are not the final answer in planning and conducting agricultural technician programs. We hope that the experiences gained through the utilization of these materials during the coming year will assist us in their further refinement.

Your attention is directed to the evaluation form which accompanies each module. Persons using these materials are asked to complete the form and return it to The Center. We believe these evaluations, based on actual experiences, will provide a valuable basis for further improvement and will help identify voids in existing materials.

ROBERT E. TAYLOR
Director
The Center for Research and
Leadership Development in
Vocational and Technical Education

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FOREWORD

The present high level of interest by representatives of education, agriculture, and industry in the general field of agricultural chemicals technology can be attributed to a number of factors.

The changes brought about in agriculture by the adoption of technological innovation has placed demands upon the agricultural manpower force for workers with skills and abilities heretofore not needed. Specialization in production, management, and mechanization is requiring the qualification of a new kind of worker--the technician.

Under the pressure of economic forces being exerted, producers are making effort to maximize production. Margins of net return per unit of production are continually being decreased, making it necessary for agriculturists to avail themselves of every assistance in order to maximize production. The use of chemicals is one way to accomplish this goal.

The interest of national leaders, educational as well as political, in the level-of-preparation of workers in all vocational and professional areas is reflected by the legislative enactment and educational implementation of programs under such acts as the National Defense Education Act, the Vocational Education Act of 1963, the Manpower Development and Training Act, the Higher Education Act, the Economic Opportunity Act, and others.

The movement of the agricultural labor situation toward the central focus of many interested national, state, and regional groups has placed demands upon agriculture not previously experienced. The successful resolvement of many of the issues being considered depends largely upon the level of technological understanding and know-how which can be developed by agricultural workers.

As early as three years ago at the National Center for Advanced Study and Research in Agricultural Education, staff members and advisory committee members at The Ohio State University, concerned themselves, during summer workshops, with developing in agriculture education, leaders to give direction and stimulus to the preparation of persons needed in the changing agricultural manpower force. One year later, during the summer of 1964, a national seminar was conducted at The Center by national and state leaders of agricultural education. The preparation of technical workers to engage in various agricultural pursuits was the concern of this seminar group.

Early in 1965, the Advisory Committee to The Center, now The Center for Research and Leadership Development in Vocational and Technical Education, recommended that consideration be given to the education needs of workers engaged in the field of agricultural chemicals. This suggested curriculum guide was prepared in response to that recommendation. It is intended for use as an aid to school administrators, supervisors, and teachers who are planning and developing programs for educating highly skilled workers in Agricultural Chemicals Technology. It should also be of use as an aid to evaluate existing programs.

Jerry J. Halterman
Director, Agricultural Chemicals
Technology Study

ACKNOWLEDGEMENTS

The Center for Research and Leadership Development in Vocational and Technical Education, The Ohio State University, acknowledges the valuable contributions made by different persons to the preparation, development, and review of the materials presented in this publication. Appreciation is extended to the following for service rendered:

Le Roy Barker, Professor of Agronomy, Chico State College, Chico California.

James E. Christiansen, Assistant Professor, University of Florida, Gainesville, Florida.

Robert Kerwood, Assistant Teacher Trainer, University of West Virginia, Morgantown, West Virginia.

H. Dean Mc Neilly, Chairman, Department of Agriculture, Delta College, Stockton, California.

E. D. DeRemer, Director of Special Agriculture Programs, Northeastern Junior College, Sterling, Colorado.

Jordon Smith, Professor of Agronomy, Chico State College, Chico, California.

E. A. Tarone, Chairman, Department of Agriculture, Modesto Junior College, Modesto, California.

The Center also extends appreciation to the many representatives of various educational institutions, commercial firms and institutes, governmental agencies, and private businesses who contributed suggestions, responded to questionnaires and inquiries, and shared resource materials. Included among these are persons in Junior Colleges, State Colleges, and Universities; Cooperative Extension Services; Fertilizer, Pesticide, and other Agricultural Chemicals Firms; U. S. Department of Health, Education and Welfare - Office of Education - Technical Education Branch; and the U. S. Department of Agriculture.

Special appreciation is extended to Robert Knoebel, Director, and Walter J. Brooking of the Technical Education Branch of the U. S. Office of Education for permission to use materials from the publication, "Chemical Technology" OE - 80031, 1964.

Dr. Dale DeRemer, Director of the Special Agriculture Program, Northeastern Junior College, was most generous in sharing materials which have been developed for use in the agriculture business curriculum at Sterling, Colorado.

"Mention of trade names or firms in this curriculum guide is made solely to provide information and does not constitute a recommendation, guaranty, or warranty of the product or firm, nor does it express approval to the exclusion of other comparable products or firms."

PART I

A SUGGESTED TWO YEAR POST HIGH SCHOOL CURRICULUM IN AGRICULTURAL CHEMICALS TECHNOLOGY

INTRODUCTORY STATEMENT

This suggested curriculum guide is designed to provide an intensive two-year full-time program of study and work experience education for students in agricultural chemicals technology. The courses in this post high school program are planned and organized to provide the chemical, biological, business, mathematical, and agricultural theories combined with procedural and technical skills involved in their application to the broad field of agriculture. Such a departure from the generally accepted pattern of qualifying highly skilled workers in agriculture suggests the necessity of an introductory statement.

During recent months there has been much concern regarding the availability of technical workers in many segments of our agricultural manpower force. Agricultural leaders from teacher training institutions, state vocational education supervisory staffs, and representatives of national educational groups have met many times and at various levels to study different aspects of this topic. Representatives of management and labor have been included in most of the sessions held. Invariably, regardless of the field of agricultural labor studied, the consensus has been the same. There are shortages of qualified workers at the technical level and not very much has been done in recent years to alleviate the situation.

In January of 1965, the staff and the advisory committee of The Center for Research and Leadership Development in Vocational and Technical Education at The Ohio State University recommended development of curricular materials in a number of areas based on research and emerging trends which were particularly pertinent at that time to manpower problems in agriculture and which needed further detailed study. The area of agricultural chemicals at the technician level was one of these.

The support for this recommendation by the staff and advisory committee is found in the results of research conducted by several States and previously reported to The Center. Consultation with leaders from industry, education, and agriculture resulted in a further recommendation that the study in the field of agricultural chemicals should be concerned primarily with the educational needs of workers engaged in sales-service work. This additional recommendation was also supported in the findings of the research reported by various States. These reports indicated that a large proportion of the positions available in industry were in the area of sales and service.

The Field of Agricultural Chemicals

The agricultural chemicals industry is one of the most rapidly expanding industries in the United States, if not the world. The utilization of chemicals in agriculture continues at an unprecedented rate. Research in both the fields of chemistry and agriculture almost daily results in new innovations, technologies, and products.

The challenge to avert the consequences of poor nutrition, disease, insect infestation, and unfavorable environmental conditions attendant to the production of plants and animals is one which the chemist shares with many others. The ever-present drive in each of us to learn to increase levels of performance and efficiency is shared by the chemist who seeks to make practical application of his scientific knowledge. The result is that the field of agricultural chemicals abounds with emerging technologies of procedures, products, and processes which requires persons qualified at the technical level who are able to translate these technologies into practical applications.

Agricultural Technicians

The make-up of the agricultural manpower force for many years has been thought of as being composed of workers who can be placed on a continuum representing level-of-occupational preparation. At one end of the continuum, the scientists and professional workers have been placed, and at the other end, unskilled workers.

Unskilled	Semi-Skilled	Skilled	Highly Skilled	Professional	Scientists

Agricultural ↗ Technician

A number of authors have suggested this continuum is indicative of the proportions of manipulative and cognitive skills required of workers. The work of the scientist being predominately cognitive and that of the unskilled worker manipulative.

Only recently has recognition been made of the emergence of a technical worker in agriculture located at a point between the highly skilled artisan and the professional. The following definition of an agricultural technican was adopted by a group of over one hundred supervisory, teacher education, and institutional representative personnel from over forty states who met in a week-long seminar on the subject "Preparing Agricultural Technicians," July 1, 1964 at The Ohio State University:

> An agricultural technician is a worker located in job classification structure, in his work performance, and in his educational attainment between the skilled worker and the professional. He possesses the skill and ability, working independently or with minimal supervision from a professional to analyze and interpret information, diagnose problems, make decisions, and make practical applications of theoretical knowledge in performing specific tasks in a specialized field in the production, processing, distribution, or marketing of goods and services in agriculture. He must exercise cognitive skills primarily, but, also, must be able to supervise and perform manipulative skills.[1]

Inasmuch as the position of the technician lies between the skilled worker and the professional it is possible to characterize each of these kinds of workers in terms of the work they do and also in terms of the nature of the educational programs by which each is qualified. The newness of the technical worker in agriculture suggests that a brief summary be presented of the attributes and characteristics of technicians and of technical education.

1. Technicians are most appropriately characterized by the level of technical qualification they possess. Technical level preparation is located on a level-of-preparation continuum between the professional level and the skilled crafts level.

2. Technical education characteristically is:

    a. Post-high school
    b. Terminal
    c. Occupation centered
    d. Less than baccalaureate degree level
    e. Specific preparation for employment
    f. Oriented toward mathematics and science
    g. Two years in length

3. Emphasis in technical education is upon technical and cognitive skill in contrast to manipulative skill.

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[1] Proceedings of the National Seminar on Agricultural Education Sponsored by the National Center for Advanced Study and Research in Agricultural Education, The Ohio State University, Columbus, Ohio, July 20-24, 1964.

4. Emphasis is upon skill and ability to make practical applications of theoretical knowledge in performing specific tasks in a specialized field.

5. Emphasis is upon occupational competency.

6. Analysis is made of occupations to determine needs and job analysis is the basis of curriculum development.

7. Preparation is made for occupational proficiency in families or clusters of jobs.

8. A proper balance of general education, technical education, and related education subjects is maintained.

9. Technicians are characterized and distinguished by their distinctive abilities, level of occupational competence, and specialized training.

10. Technicians usually work in support of or under the supervision of professional personnel and frequently perform tasks that would otherwise be done by professional workers.

The true technical institute-type training program is unique in form and content. It serves a function not commensurate with either professional education or vocational training. It can be expected that students who benefit most from this type program are (1) those who are intensely interested in a specific technological field and (2) those who want a technological education, but who for some reason or another do not undertake a four or five-year baccalaureate degree program.

It should be emphasized that technical education students are, for the most part, capable individuals, many of whom are not interested in formal academic study toward the baccalaureate degree. Henninger reiterates "that" for them the technical institute is not an alternative educational program. In reality, it represents the best course of study, serving a need not met by any other instructional program.[2]

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[2] Jerry J. Halterman, "Determination of Educational Needs of Agricultural Engineering Technicians in Ohio," (unpublished Ph.D. dissertation, The Ohio State University, 1964).

In addition to the references cited on above, two other publications are recommended which pertain to developing and establishing technician training programs. Clary's work is particularly pertinent. The guidelines developed in his study were found to be acceptable and usable as important considerations in the successful development of technician programs. The supporting statements he used to provide suggestions for implementing the major guidelines were also found to be highly useful. (See Appendix A)

1. Joseph R. Clary, "Guidelines for the Development of Training Programs for Agricultural Technicians," (unpublished Ph.D. dissertation, The Ohio State University, 1964).
2. Lynn A. Emerson, "Technician Training Beyond the High School," State Department of Public Instruction, Raleigh, North Carolina, June, 1962.

The Educational Needs of Agricultural Technicians

In addition to the supportive data and information pertaining to the need for agricultural chemicals technicians, which had already been submitted to The Center for Vocational and Technical Education at The Ohio State University, the necessity was seen for further inquiry regarding specific educational needs of these technical workers. Two efforts were made to satisfy this problem: (1) Personal interviews were conducted with persons involved in agricultural chemicals sales work at different occupational levels. Owners, personnel managers, sales managers, labor managers, and field men were asked to participate. A summary of these interviews is given in Appendix B. (2) A random sampling was made of leaders in the agricultural chemical industry. Reactions to selected questions were solicited by means of a mail questionnaire. A summary of these reactions is reported in Appendix C.

A study was made of the Agri-business program which had recently been developed in the field of agricultural chemicals at Northeastern Junior College, Sterling, Colorado. In this program a rather extensive curriculum has been developed for preparing persons for employment in the fertilizer industry. Representatives from education, agriculture, and industry worked cooperatively to develop a training program which, in many respects, is similar to the one envisioned under this project.

Van Loh and Bundy studied the competencies needed by fertilizer retailers and reported their findings in The Agricultural Education

Magazine, January, 1965. The 10 most needed competencies as evaluated by managers, sales employees, and service employees are as follows:

1. Amounts of fertilizer required for various levels of crop production.
2. Seed quality and plant population relative to fertilizer response.
3. Weed and insect problems and their control.
4. Interpreting a soil test report.
5. Identifying fertilizer materials and evaluating formulas.
6. Making proper recommendations regarding fertilizer use and help individual customers keep a fertilization history on his farm.
7. Recognize good, new fertilizer practices and recommend their use.
8. Recognizing plant food deficiency in growing crops.
9. Making recommendations in absence of a soil test report.
10. Determining an individual's financial situation and management level.

Appendix D is used to present the results tabulated for 16 of 29 competencies studied in this project.

Agricultural Chemicals Technicians

The following is a summary of the operational framework within which agricultural chemicals technicians perform their work.

A. The Technical Worker Has a Working Knowledge of Producing and Marketing

Plants

- Seedbed preparation
- Planting/Propagating
- Fertilization
- Weed Prevention/Control
- Disease Prevention/Control
- Insect Prevention/Control
- Environmental Control
- Irrigation
- Harvesting
- Storage
- Marketing
- Management
- Mechanics
- Processing

Animals

- Breeding
- Nutrition
- Feeding
- Parasite Prevention/Control
- Insect Prevention/Control
- Disease Prevention/Control
- Environmental Control
- Selection
- Marketing
- Storage
- Mechanics
- Processing
- Buildings/Housing

B. In the process of working with plants or animals, situations, conditions, and problems either are encountered or are anticipated which can be modified, alleviated, controlled, prevented, or altered by the use of chemicals. The technician can be expected to be competent in:

1

RECOGNITION - of the problem, situation or condition where the use of chemicals will be advantageous.

2

DIAGNOSIS - define the problem, propose a hypothesis, secure the facts, test the hypothesis.

3

PRESCRIPTION - on the basis of the diagnosis, apply theoretical knowledge and practical understanding and propose a course of action.

4

APPLICATION - apply the proposed course of action.

5

EVALUATION - make a determination of the results secured from action taken.

6

FOLLOW-UP - on the basis of the results secured, determine what action should yet be taken.

An analysis of the above framework within which technicians operate indicates that activities which these workers engage in can be grouped. The following is a listing of some of these groups:

Groups of Activities Engaged in by Agricultural Chemicals Technicians

1. Give leadership and direction to others -- manage, supervise, direct, oversee, govern, program.
2. Publicly show and encourage the adoption and use of goods and services -- demonstrate, promote, sell, exhibit, display, market, serve as change agents.
3. Use physical, chemical, and biological principles and techniques to form new applications -- invent, plan, design, originate, devise, create.
4. Communicate ideas and information to others -- illustrate, depict, diagram, design, layout, blueprint, portray.
5. Make a verbal or written accounting to others -- relate, report, notify, tell, account, inform, apprise, advise.
6. Maintain and keep in operational repair -- adjust, service, maintain, minor repairs and replacement of parts.
7. Determine why there has been success or failure -- inspect, examine, survey, analyze, investigate, study, inquire, review, test, troubleshoot.
8. See if something works, try out, ascertain by experiment, compare for proof -- test, prove, give a trial, verify.
9. Operate and/or make proper application and use of in the field -- operate, perform, adjust, manipulate, calibrate, control, adapt, hitch, regulate.
10. Offer advice and expertness to others -- advise, counsel, recommend, suggest, advocate, instruct, prescribe.
11. Evaluate results, determine the value of and come to a conclusion -- evaluate, assess, appraise, rate, estimate, value, judge, select.
12. Plan a course of action -- formulate, propose, decide on, recommend, specify, prescribe.
13. Identify and recognize various elements of situations, conditions, and circumstances -- become aware of, cognizant, alert to, analyze.
14. Procure pertinent information relevant to particular situations, conditions, items, and circumstances -- research, investigate, find out, study, obtain.
15. Other ----

THE NATURE OF THE PROGRAM DEVELOPED

This two-year post high school program in agricultural chemicals technology is designed for use in preparing persons for entry primarily at the technical level into chemical supply sales and service occupations.

The curriculum has been prepared on the quarter basis and courses have been suggested for a full two-year program. Extended study guides have been prepared for each of eight selected specialized courses. These courses hopefully are the ones which put the "cutting edge" on the technician and are the ones which provide for a high level of technical competency. Brief course outlines are presented for other general and supporting technical courses.

The format used in the preparation of study guides for the technical specialty courses was developed by personnel at The Center for use by workers developing instructional materials in a number of areas. Some modification was necessary in order that the "course" approach rather than the "modular" approach could be used. The course approach presumes prerequisite courses are necessary in preparation for subsequent study and this is true of this program.

The futility of preparing an educational program which might have universal applicability in agricultural chemicals technology across the nation is recognized. The diversity of pests, soils, crops, and other factors of production precludes the possibility of developing a proposed program which might have equal utility for all who might prepare workers at this level. However, in preparing this curriculum, an attempt has been made to present a study outline of sufficient depth and scope which will be useful in stimulating thought, triggering imagination, and in challenging ingenuity and creativity of teachers in whatever part of the country they may be teaching. Much local adaptation will be necessary for most areas.

The curriculum for agricultural chemicals technology can be thought of as being made up primarily of courses in three areas. Attempt is made to qualify the technician in the specialty areas of agriculture, chemistry, and business. Agriculture needs to be stressed because of the necessity the technician has to be able to be a practioner and to be able to apply theoretical understandings in practical situations encountered in agriculture. Chemistry needs to be stressed because of the necessity to secure a theoretical understanding of the chemical resources available for use. Business needs to be stressed because of the commercial setting within which most technical workers are engaged.

AN OVERVIEW OF THE CURRICULUM

Purpose of the Education Program:

To develop the skills, abilities, attitudes, appreciations, knowledge, and understanding needed by persons at the post high school level for occupational entry and advancement as technicians in occupations which have to do with selling of agricultural chemicals, servicing agricultural chemical accounts, and advising in regard to the use of chemicals in agriculture.

Occupations for Which the Curriculum is Intended:

Agricultural Chemical Product Salesman
Agricultural Chemical Product Serviceman
Agricultural Chemical Equipment Salesman
Agricultural Chemical Equipment Serviceman
Agricultural Chemical Production and Control Technician
Agricultural Chemicals Technician
Agricultural Chemicals Specialist
Agricultural Chemicals Applicator
Farm Management Consultant

Suggested Time Allotments:

(Based on fifty-minute lecture periods and three-hour laboratory periods conducted on the Quarter System--3 12-week quarters per year)

At school

Class Instruction	864 hours total	
Laboratory Experience	828 hours total	
Total at School		1,692 hours total
Occupational experience recommended		480 hours total
Total for the Curriculum		2,172 hours

Persons to be Served:

1. High school graduates or other qualified persons who desire employment in the field of agricultural chemicals at the technical level.

2. Persons who are presently working in the field of agricultural chemicals and desire to become more proficient and technically qualified.

3. High school and college drop-outs who are capable of mastering the skills, abilities, and understandings necessary for occupational entry in agricultural chemicals occupations and who show an earnest desire to enter such employment.

4. Unemployed persons capable of carrying out the responsibilities of job positions in the field of agricultural chemicals and who show an earnest desire for occupational preparation.

5. Persons with agricultural backgrounds who desire to be educated and updated in agricultural chemicals technology.

Supporting Education Needed:

This program is designed to be taught at the technical level and presumes high school preparation or its equivalent. Pre-technical study in the fields of mathematics, chemistry, biological sciences, and agricultural business and production are highly beneficial but are not mandatory. Practical experience in some field of agricultural production is especially useful. Courses that will correct educational deficiencies of the enrollees should be included as a part of the course of study the student is pursuing. Such courses, where provided, need not be considered part of the technical curriculum.

Suggestions for Introducing the Program:

At the first class meeting the instructor should give the enrollees a broad overview of the program and develop enthusiasm on the part of the enrollee toward agricultural chemicals curriculum. The instructor should discuss with the enrollees the following items during this meeting:

1. Why the program is needed.
2. What will be attempted.
3. The major areas to be dealt with.
4. How the program will benefit the enrollee and why the major course areas are important.
5. How the teaching will be done--the class schedule, the occupational experiences to be provided at the school and on the job.
6. The role of the classroom instructor.
7. What is expected of the student.
8. Occupational opportunities.

It is essential that all these points be made clear to the enrollees, and that they accept them as being important. Opportunities for enrollees to discuss these points and to ask questions are essential. The idea of cooperation and working together should be emphasized at the first class meeting. It is usually good to get into the subject matter of each course itself during the first class period. The extent of this work may be limited, but the important thing is to begin--and to make an effective beginning.

Discuss with the students the types of agricultural chemicals used in your area. Develop as complete a list as the experiences of the students will permit. Group the kinds suggested according to the uses made of the chemicals. The list should include chemicals used as fertilizers, soil additives, herbicides, insecticides, fungicides, bactericides, nematocides, plant regulators, miticides, molluscicides, and rodenticides.

Develop a list of persons in your community who have need for a knowledge of agricultural chemicals. Examine the kinds of activities these workers engage in and from the study determine the skills, abilities, and understandings these workers need to have in order to do their work. Some of the things which should be listed include:

1. Safe and lawful use of agricultural chemicals.
2. An appreciation of man's attempt to control the world about him through the use of chemicals.
3. A technical working knowledge concerning the nature of the chemical resources available for use in agriculture.
4. An understanding of the principles and concepts which are made use of in the field of agricultural chemicals technology.
5. The ability to propose and put into practice programs of action in the various specialty areas of agricultural chemicals technology.

The value of agricultural chemicals cannot be put in terms of dollars. It is difficult to measure the additional production we derive from the use of chemicals and more difficult to determine the amount of production lost by inadequate or improper use of chemicals. Use of chemicals assists us in protecting our harvest while in storage. Large amounts of food and fiber are still lost by failure to use chemicals properly. Even more important, how do you measure the lives of thousands of the world's starving people lost daily because chemicals are not used or not used effectively.

The following figures should startle and arouse an interest in agricultural chemicals among your students:

1. By the year 1975, the United States' population will increase by approximately 50 million people. This will require 47 billion more pounds of milk, 16 billion more

pounds of meat, 20 billion more eggs, and 31 million more tons of fruits and vegetables. At present levels of production this would require 200 million acres of farm land--land we don't have. Will we need chemicals to reduce the losses of food and fiber due to disease, insects, and weeds?

2. By the year 2000, we will need to produce more food on one acre than we presently produce on two acres to feed the exploding population. Will pesticides help do the job?

3. Two out of every three world citizens do not have a sufficient diet. Will man fight disease and hunger with chemicals or go to war with other men in a fight for food?

4. In Africa, it is estimated that forty per cent of the harvested crops are destroyed by pests while thousands of people starve. Are we going to feed pests or people?

5. In the United States, it is estimated that rodents alone destroy enough food annually to feed the entire population of Chicago for a year. Can we continue this wastefulness?

Economic losses due to insects, diseases, weeds, and other pests are numerous and they:

1. Reduce yields from crops
2. Reduce production from livestock
3. Lower quality of crop and livestock products
4. Destroy food and fiber in storage
5. Infest and contaminate our food and water supply
6. Reduce man's ability to work effectively
7. Increase our costs of production
8. Reduce our land values
9. Limit our crop choices
10. Damage our buildings and equipment

Specific examples of these types of economic losses are common in all communities. Tying these general losses to common problems in your area will make these losses more meaningful to your students.

Man's progress has been the result of his successful efforts to understand and control his environment. Had man not been blessed with this ability to bend nature to serve his needs, he might still be living in caves, the helpless victim of famine and disease.

In waging his battle for survival, man has developed pesticides designed to meet his needs, and today we have no substitute for them. In America, we have developed chemical aids to the point where starvation and disease are effectively controlled. It is only in the areas of the world where these chemical tools are used that starvation and epidemic disease are not a serious daily fear.

This chemical technology has created other problems. In winning the war on disease, population and man's life span have been expanded. In India, with the aid of pesticides, the malaria cases were reduced from 75 to 5 million cases annually in ten years with the life span of man increasing from 32 years to 47 years in the same period. Each year, more mouths must be fed and more people protected from the perils of nature. Agricultural chemicals will play a major role in this effort.

While some people still abhor the use of chemicals in the production of food and fiber, in our war against disease, agricultural chemicals are one of our main bridges from disease and famine to plenty and peace.

There is much that can still be accomplished with the use of agricultural chemicals in the United States. Some of the important areas where chemicals can be used more effectively are:

1. Weeds, the major pest in limiting crop yields in most areas, often reduce yields by 25 per cent.

2. Ten per cent of all crops are destroyed annually by insects.

    a. Cotton insects did 900 million dollars damage in one year.
    b. Corn borer caused 350 million dollars damage in a single year.
    c. Insects cause more damage to our forests than fire.
    d. Cattle grubs alone cause two million dollars damage to cattle hides annually.

3. Stem rust has reduced our total wheat yield over 25 per cent in serious years.

These are but examples of the amount of damage that weeds, insects, and diseases can cause. It is estimated that if no control was used on the pests of man, crop and livestock production would drop to ten per cent of its present level.

The field of agricultural chemicals offers expanding opportunities for young men interested in sales and service occupations. It is a challenging, ever changing field where today's modern chemicals may be as out-dated as the horse and carriage by tomorrow as chemical scientists continue their search for new, more effective, and safer chemicals to help man wage his war against disease and hunger. Because of the rapid advances being made in this area, young men entering this field will be forced to study constantly to keep up with new products and techniques in the industry.

1. Have an agricultural chemical representative discuss with the class the changes and opportunities available to young men in the industry.

2. Arrange a class trip to a firm that does considerable business in agricultural chemicals and become familiar with the types of products and services the business provides.

3. Discuss with the class the major pest problems encountered by farmers, ranchers, gardeners, home owners, and others in your community. Lists should be specific.

Courses Making Up This Program:

The following guide is used to classify various courses of the agricultural chemicals technology curriculum:

TECHNICAL SPECIALTY COURSES (Advanced Courses in the Area of Emphasis)
SUPPORTING TECHNICAL COURSES (Courses for This and Related Technologies)
GENERAL COURSES (Courses Basic to All Technologies)

I. General Courses

- Personal Development & Human Relations
- Communications Skills I (Listening, Speaking, and Reading)
- Communications Skills II (Writing & Correspondence)
- Communications Skills III (Technical Report Writing)
- Industrial Organizations & Institutions
- Personal Hygiene, Public Health Education, and First Aid

II. Supporting Technical Courses

- Agricultural Chemistry I (Inorganic)
- Agricultural Chemistry II (Organic)
- Agricultural Chemistry III (Agriculture Biochemistry)
- Introduction to Biological Science
- Agricultural Science I (Basic Agricultural Science)
- Agricultural Science II (Laboratory Techniques)
- Agricultural Chemicals Technology Seminar I
- Agricultural Business Computations (Processes, Problems, and Solutions)
- Agricultural Business I (General Agricultural and Business Economics)
- Agricultural Business II (Records & Bookkeeping)
- Agricultural Business III (Finance, Credit, Budgeting, Taxes)
- Agricultural Business IV (Selling and Merchandising)
- Agricultural Business V (Agricultural Business Management)
- Introduction to Soils
- Introduction to Plant and Animal Entomology
- Introduction to Weed Science
- Agricultural Mechanics I (Tractors, Engines & Farm Machinery)
- Agricultural Mechanics II (Agricultural Chemicals, Machinery and Equipment)
- General Crops Production
- Agricultural Production (Course appropriate to the area)
- Agricultural Production (Course appropriate to the area)

III. Technical Specialty Courses

Teaching Modules Making Up the Course

- The Use of Chemicals as Fertilizers
- The Use of Chemicals as Soil Additives
- The Use of Chemicals as Insecticides (Plants)
- The Use of Chemicals as Fungicides, Bacteriocides & Nematocides
- The Use of Chemicals as Herbicides
- The Use of Chemicals as Plant Regulators
- The Use of Chemicals in the Areas of Farm Animal Nutrition, Pathology and Entomology
- The Use of Chemicals to Control Field Rodents and Other Predators

Suggestions for Evaluating the Program

The following criteria should be used in evaluating the effectiveness of the program:

1. Number of enrollees completing the program who have been employed in agricultural chemical occupations for which they were trained.
2. Number of persons employed in occupations for which they were trained a year or more after completion of the program.
3. Acceptance of the course by present and future employers.
4. Employer evaluations of the quality of work done by employees who have completed the program.
5. Number of students who are continuing their training after employment.
6. Reaction of enrollees toward the course of study.
7. Enrollment trends.
8. Reasons given by enrollees who terminated their training and/or employment.
9. Ability to place students.
10. Number of former students who have advanced to a higher level of employment.
11. Social mobility of the enrollee after completion.

SUGGESTED CURRICULUM

Technical competence in a broad field such as agricultural chemicals technology has at least four components around which the curriculum must be structured: (1) the training should prepare the graduate to take an entry job in which he will be productive, (2) the broad, technical training, together with a reasonable amount of practical experience, should enable the graduate to advance to positions of increasing responsibility, (3) the foundation provided by the training should be broad enough so that the graduate can do further study within his field of technology, and (4) the training program should be strongly oriented toward the needs of the chemical industry serving agriculture. This curriculum has been designed to meet these four needs.

A two-year technology program has certain unique requirements that influence the content and organization of the curriculum. Some of these requirements are imposed by the occupational functions that graduates must be prepared to perform; some result from the need for special courses that will maximize the effectiveness of teachers who have special competencies; and others arise because of the need to teach both technical principles and related practical applications in the limited time available. The agricultural chemicals technology curriculum reflects three basic requirements; functional utility, units of instruction in specialized technical subjects, and provision for the teaching of principles by application.

The sequence of the courses in a two-year technical curriculum is as important as the content of the courses. In general, the subject matter in a technical curriculum is carefully correlated in groups of concurrent courses. This is in sharp contrast to the arrangement of professional curriculums in which basic and somewhat unrelated courses make up the first part of the study program and specialization is deferred to subsequent terms.

In technical curriculums, it is mandatory that specialized technical course work be introduced in the first term. Deferring this introduction even for one term imposes serious limitations on the effectiveness of the total curriculum. Several important advantages accrue from the early introduction of the technical specialty: (1) student interest is caught by practical aspects and if the first term consists entirely of general subjects--mathematics, English, social studies--students often lose interest, (2) by introducing technical study in the first term, it is possible to obtain greater depth of penetration in specialized subjects in the latter stages of the two-year program, (3) the student, as well as the instructor, can begin evaluating his possible success in the field, and (4) maximum practice to the application of general and supporting course subject matter to the technical courses is obtained. The student's study in these auxiliary courses is reinforced by his appreciation of the disciplinary values obtained therefrom and the need for these values in technical study.

An agricultural chemicals technician must have a comprehensive understanding of basic chemical, biological, and related physical science, and must be able to do sampling, analyses, calculations, interpretation, and reporting required in applied chemistry in agriculture.

Technical specialty, supporting technical, and general courses need to be started immediately and taught intensively, since all three are interrelated. The subject matter of each should be presented in a carefully coordinated sequence so each reinforces the other. This is essential to provide maximum effective use of the limited time available for learning in a two-year curriculum. As each course builds on and reinforces the other, the student's comprehension and interest increase.

The agricultural chemicals technology seminar suggested for the first quarter is designed as a working course with lectures, demonstrations, reports, and outside assignments. Its purpose is to provide the student with a frame of reference regarding the agricultural chemicals industry and how his education as a technician fits him to do interesting and challening work in this field.

The general courses are considered to be of three kinds: (1) Courses in the area of communications emphasize the mechanics of reading, writing, listening, speaking, and reporting. Instructors should establish standards of clarity, conciseness, and neatness in these courses. (2) The social science courses are designed to broaden the student's concepts and perception of the society in which he lives and will be employed. These courses include broad ecnomic and industrial concepts and sufficient emphasis on corporate structure and economics to enable the student to comprehend the terminology and recognize the motives, methods, objectives, and administrative procedures of employers. (3) Two courses are provided to enhance the student's ability to better care for himself in the conduct of his private and public life.

The supporting technical courses are designed to provide a broad foundation for this and related technologies. Emphasis is placed on the use of mathematics, biological science, chemistry, business, and agriculture in agricultural chemicals technology.

Eight technical specialty courses are presented. Some overlap in subject matter may occur among these eight courses and by design it is intended that there should be a close relationship of the content of these courses and the supporting technical courses. The overlap here is provided for mainly as orientation and review.

The course study guides are intended as guides rather than specific plans of instruction. It is expected that the principles, concepts, and theories studied in these courses will be supplemented and reinforced with practical applications wherever possible.

A suggested curriculum outline by quarters appears as a chart on the following three pages.

SUGGESTED AGRICULTURAL CHEMICALS STUDY PLAN•

•In each course the emphasis is upon meeting the needs of agricultural chemicals technicians.

QUARTER					
1	2	3	4	5	6
Communications Skills I (Listening, Speaking, and Reading)	Communications Skills II (Writing and Correspondence)	Communications Skills III (Technical Report Writing)	Agricultural Science II (Laboratory Techniques)	Personal Hygiene, Public Health Education, and First Aid	Industrial Organizations and Institutions
Agricultural Chemistry I (Inorganic)	Agricultural Chemistry II (Organic)	Agricultural Chemistry III (Agriculture Biochemistry)	Introduction to Plant and Animal Pathology	Fungicides, Bactericides, and Nematocides (The Use of Chemicals as . . .)	Farm Animal Nutrition, Pathology and Entomology (The Use of Chemicals in the areas of..)
Agricultural Chemicals Technology Seminar I	Agricultural Business I (General Agricultural and Business Economics)	Agricultural Business II (Records and Bookkeeping)	Agricultural Business III (Finance, Credit, Budgeting, Taxes)	Agricultural Business IV (Selling and Merchandising)	Agricultural Business V (Agricultural Business Management)
Agricultural Mechanics I (Tractors, Engines and Farm Machinery)	Agricultural Mechanics II (Agricultural Chemicals, Machinery and Equipment)	Agricultural Science I (Basic Agricultural Science)	General Crops Production (Course Appropriate to the Area)	Agricultural Production (Course Appropriate to the Area)	Agricultural Production (Course Appropriate to the Area)
Agricultural Business Computations (Processes, Problems and Solutions)	Introduction to Soils	Fertilizers (The Use of Chemicals as . . .)	Soil Additives (The Use of Chemicals as . . .)	Rodents and Predators (The Use of Chemicals to Control Field)	Personal Development and Human Relations
Introduction to Biological Science	Introduction to Plant and Animal Entomology	Insecticides (Plants) (The Use of Chemicals as . . .)	Introduction to Weed Science	Herbicides (The Use of Chemicals as . . .)	Plant Regulators (The Use of Chemicals as . . .)

SUGGESTED CURRICULUM OUTLINE

First Year

	Units	Class Hours	Laboratory Hours	Total Hours
First Quarter				
Communications Skills I (Listening, Speaking, & Reading)	3	3	0	3
Agricultural Chemistry I (Inorganic)	4	3	3	6
Agricultural Chemicals Technology Seminar I	1	1	0	1
Agricultural Mechanics I (Tractors, Engines, & Farm Machinery)	2	1	3	4
Agricultural Business Computations (Processes, Problems, & Solutions)	3	3	0	3
Introduction to Biological Science	3	2	3	5
	16	13	9	22
Second Quarter				
Communications Skills II (Writing and Correspondence)	2	2	0	2
Agricultural Chemistry II (Organic)	3	2	3	5
Agricultural Business I (General Agricultural & Business Economics)	3	3	0	3
Agricultural Mechanics II (Agricultural Chemicals Machinery & Equipment)	2	1	3	4
Introduction to Soils	3	2	3	5
Introduction to Plant & Animal Entomology	3	2	3	5
	16	12	12	24
Third Quarter				
Communications Skills III (Technical Report Writing)	2	2	0	2
Agricultural Chemistry III (Agriculture Biochemistry)	3	2	3	5
Agricultural Business II (Records & Bookkeeping)	2	2	0	2
Agricultural Science I (Basic Agriculture Science)	3	2	3	3
*The Use of Chemicals as Fertilizers	3	2	3	5
*The Use of Chemicals as Insecticides (Plants)	3	2	3	5
	16	12	12	22

*Extended study guides are presented in a subsequent section.

SUGGESTED CURRICULUM OUTLINE

Second Year

	Units	Class Hours	Laboratory Hours	Total Hours
Fourth Quarter				
Agricultural Science II (Laboratory Techniques)	2	1	3	4
Introduction to Plant & Animal Pathology	3	2	3	5
Agricultural Business III (Finance, Credit, Budgeting, Taxes)	3	3	0	3
General Crops Production	3	2	3	5
*The Use of Chemicals as Soil Additives	2	1	3	4
Introduction to Weed Science	3	2	3	5
	16	11	15	26
Fifth Quarter				
Agricultural Business IV (Selling & Merchandising)	3	3	0	3
Personal Hygiene, Public Health Education, & First Aid)	2	2	0	2
*The Use of Chemicals as Fungicides, Bactericides, & Nematocides	3	2	3	5
Agricultural Production Course (Appropriate to the Area)	3	2	3	5
*The Use of Chemicals in the Area of Field Rodents & Other Predators	2	1	3	4
*The Use of Chemicals as Herbicides	3	2	3	5
	16	12	12	24
Sixth Quarter				
Agricultural Business V (Agricultural Business Management)	3	3	0	3
Industrial Organizations & Institutions	3	3	0	3
*The Use of Chemicals in the Areas of Farm Animal Nutrition, Pathology, & Entomology	3	2	3	5
Agricultural Production Course (Appropriate to the Area)	3	2	3	5
Personal & Human Relations	2	2	0	2
*The Use of Chemicals as Plant Regulators	3	2	3	3
	17	14	9	21

*Extended study guides are presented in a subsequent section.

PART II

COURSE OUTLINES

General, Auxiliary, and Supporting Technical Courses

FIRST QUARTER COURSES

Communications Skills I
(Listening, Speaking, & Reading)

Agricultural Chemistry I
(Inorganic)

Agricultural Chemicals Technology Seminar I

Agricultural Mechanics I
(Tractors, Engines, & Farm Machinery)

Agricultural Business Computations
(Processes, Problems, & Solutions)

Introduction to Biological Science

COMMUNICATION SKILLS I

(Speaking and Reading)

Hours Required

Class, 3; Laboratory, 0

Description

This course is designed to enhance the student's skill in listening, speaking, and reading. Topics for student oral reports and reading assignments are chosen from material discussed in their technical courses. This course, along with the second semester course in communictions skills, integrates the basic communication skills with practical vocational and industrial situations instead of treating them as discrete topics. The practical aspect of communication problems dominates the course.

Course Outline

I. The Idea of Communication; A Point of View (Reading & Speech Stressed)

   A. Analysis of the communications process

   B. Examination of the problems involved in the effective use of the basic communication skills

   C. Relationship of language and maladjustment

   D. Dynamics of language

      1. Changes according to time, place, and environment

      2. Levels of usage

      3. View toward grammatical conventions

   E. Meaning and value in words and phrases

II. Investigating and Designing Oral Composition

   A. Choosing the subject

   B. Limiting the subject

   C. Determining the purpose

   D. Gathering, selecting, and organizing the material

   E. Examining the forms of discourse: argumentation, description, narration, persuasion

   F. Using aids: dictionary, thesaurus, library, note-taking, outlining

III. Developing the Composition (Oral)

   A. Being specific (words, ideas)

      1. Defining terms

      2. The process of definition

      3. Types of meaning - connotative and denotative

   B. Methods of presentation

   C. Organization

   D. Developing the central idea: forming, stating, supporting

   E. Composing the sentence, paragraph, the whole composition

IV. Process Explanation

   A. The nature of expository composition

   B. Planning the explanation

   C. Presenting the explanation

V. Reading

   A. Techniques of silent reading

   B. Vocabulary study

   C. Paragraph analysis

   D. Improving reading speed and comprehension

AGRICULTURAL CHEMISTRY I

(Inorganic Chemistry)

Hours Required

Class, 4; Laboratory, 3

Description

A study of fundamental principles and concepts in chemistry; atomic structure; chemical bond; the periodic classification of elements; chemical equilibrium, ionization, and reaction; and properties of selected elements and their compounds, acids, bases, salts, solutions and colloids. Laboratory experiments illustrate chemical principles and develop laboratory techniques. This introductory course is designed to provide an understanding needed by technicians in agricultural chemicals technology. The student should acquire a theoretical understanding of the discipline and also be able to make practical applications in the field.

Course Outline

I. Introduction and Fundamental Principles

   A. Introduction and historical background

   B. Units of measurement - Dimensional analysis

   C. Matter and its changes

   D. Laws of chemical change

   E. Symbols and formulas

   F. Valence, covalence

   G. Molecular weight, formula weight

II. Atomic Structure

   A. Atomic theory

   B. Atomic weights, equivalent weights

- C. Electron, proton, neutron
- D. Modern theory of atomic structure
- E. Molecular weight, formula weight, mole

III. Periodic Classification

- A. The periodic table
- B. Relationship of modern atomic theory to the periodic table
- C. Ionization potential
- D. Physical and chemical behavior
- E. Uses of the periodic table

IV. Formulas and Chemical Equations

- A. Formulas
- B. Chemical equations
- C. Types of chemical changes
- D. Percentage composition

V. Oxygen and Hydrogen

- A. Oxygen
- B. Hydrogen

VI. The Gaseous State

- A. Atmospheric pressure
- B. Pressure -- volume relationship
- C. Temperature -- volume relationship
- D. Combined gas laws
- E. Standard temperature and pressure

VII. Classification and Nomenclature

- A. Acids and their properties
- B. Bases and their properties
- C. Salts
- D. Ionic equations
- E. Reaction types

VIII. Water and the Liquid State

- A. Properties of liquid state
- B. Evaporation
- C. Boiling point
- D. Surface tension
- E. Viscosity

IX. Solutions and Colloids

- A. Solutions; solute and solvent
- B. Types of solutions
- C. Equilibrium in solutions
- D. Solubility of solids
- E. Solubility of gases in liquids
- F. Effect of temperature on solubility
- G. Concentration of solutions
- H. Molar solutions
- I. Normal solutions
- J. Boiling and freezing points
- K. Osmotic pressure
- L. Colloids and colloidal particles

- M. Kinds of colloidal solutions
- N. Preparation of colloidal solutions
- O. Characteristics of colloidal solutions
- P. Precipitation of colloidal particles

X. Chemical Equilibrium; Ionization

- A. Factors affecting reaction rates
- B. Chemical equilibrium
- C. Reactions which proceed to completion
- D. Effect of temperature and pressure
- E. Conductivity of solutions
- F. Neutralization reactions
- G. Buffer solutions
- H. Hydrogen ion concentration
- I. Solubility product principles

XI. Oxidation and Reduction

- A. Oxidation
- B. Reduction
- C. Oxidizing and reducing agents
- D. Oxidation - reduction equations

XII. Group VI-A Elements

- A. Sulfur
- B. Selenium and Tellurium

XIII. Group V-A Elements

- A. Nitrogen
- B. Nitrogen fixation

- C. The inert gases
- D. Ammonia and ammonium salts
- E. Nitric acid and nitrates
- F. Oxides of nitrogen
- G. Phosphorous
- H. Compounds of phosphorous
- I. Arsenic
- J. Antimony
- K. Bismuth

XIV. Group IV-A Elements

- A. Carbon
- B. Silicon

AGRICULTURAL CHEMICALS TECHNOLOGY SEMINAR I

Hours Required

Class, 1; Laboratory, 0

Description

This seminar is designed primarily to orient the beginning student in a post high school technical educational program. A brief introduction to the new type of learning situation is followed by an explanation of the objectives of the seminar and how they will be accomplished. The remainder of the time is devoted to giving the student occupational and professional orientation by means of student panel reports and class discussion on pertinent topics. These topics should be assigned to panel groups at the first or second meeting of the class, with emphasis on the principle that the student groups are responsible for preparing a report and leading class discussion on the topics assigned. Students should be given topics of their choice within the scope of the seminar, as far as possible.

By preparing themselves and leading the class discussion under the instructor's guidance, the students become informed by active involvement in the development of the topics studied. The student panels can be expanded by including guest panelists from industry or the professions. The class should be encouraged to question the panel members and even to take issue if controversial subject matter is under discussion. The discussion of the library scientific method and the practice of safety in the field of agricultural chemicals are intended to provide the student with an insight into important attitudes necessary to his success as a technician. The exploration of job opportunities in the agricultural chemicals field and educational preparation for them stimulates student curiosity and interests.

Panel reports should be written and sources documented prior to oral presentation to the class for discussion. A notebook should be required, made up of the student's part of the panel report for which he is responsible as well as complete class notes.

Seminar Outline

I. The Student and the School

  A. Physical facilities, regulations, academic requirements

  B. How to plan use of time

  C. Seminar objectives and plan of operation

  D. Notebook - required content

  E. Assignment of topics and schedule for panel reports

II. The Library and Its Use

  A. Why technicians need a library

  B. Library organization and facilities

  C. Services of the library staff

  D. How to use the library

III. Technical Personnel

  A. Occupational levels and qualifications

  B. The engineering team -- scientists or engineers, technicians, skilled craftsmen

    1) Relationship of the engineer, scientist, and skilled craftsman to the technician

  C. The chemical technician

    1) Need for constant study to maintain technical "up-to-dateness"

    2) Technical societies

    3) Formal supplementary study

IV. Opportunities in the Agricultural Chemicals Field

   A. Size and importance of chemical industry

   B. Stability and growth of chemical industry

   C. Expanding demand for trained chemical personnel

   D. Expanding need for qualified chemical technicians (few programs, chemist shortage makes for upgrading, concept of 3 or 4 technicians to each scientist)

   E. Trends in technician salaries

V. Types of Jobs in the Agricultural Chemicals Field

   A. Production, quality control, analytical

   B. Research assistant -- experimental chemical preparation, analytical methods

   C. Pilot plant, development work -- analytical, operator, supervisor

   D. Production -- operator, supervisor

   E. Sales and marketing

   F. Sales service, customer troubleshooter

VI. Industrial Firms Who Employ Agricultural Chemical Technicians

   A. Fertilizer

   B. Soil Additive

   C. Insecticide

   D. Herbicide

   E. Growth Regulator

   F. Fungicide, Bactericide & Nematocide

VII. Employment Opportunities With Firms Other Than Industrial

   A. Federal government, food and drug, military, aerospace development, agricultural research

- B. State and local public health, sanitation, water, air pollution, meteorology
- C. Teaching -- high school, technical institute, vocational-technical school, junior college, university
- D. Research foundations
- E. Technician training with additional preparation and work experience, may lead to professional level jobs.

VIII. Technical Subjects in Relation to General Education

- A. Communications: oral communication and technical reporting
- B. Economics
- C. Industrial and labor relations
- D. Human relations
- E. Need for general education knowledge and skills to obtain growth and promotion into supervisory positions

IX. Agricultural Chemicals and the Public Health

X. Salesmanship in the Agricultural Chemicals Field

XI. Summary Discussion of Seminar Topics

- A. Review of topics
- B. Analysis of values

AGRICULTURAL MECHANICS I

(Tractors, Engines, and Farm Machinery)

Hours Required

Class, 1; Laboratory, 3

Description

Field operation, servicing, adjustment, minor repair, maintenance, and set-up of gasoline and diesel engines; tractors; and tillage, seeding, and cultivating machinery and equipment. Emphasis is given to operational procedures which are often used in connection with activities engaged in to apply agricultural chemicals.

Course Outline

I. Internal Combustion Engines

   A. Maintenance, servicing, adjustment and calibration

   B. Minor repair and replacement of parts

   C. Operation and set-up

II. Wheel and Track Type Tractors

   A. Maintenance, servicing, adjustment and calibration

   B. Minor repair and replacement of parts

   C. Operation and set-up

III. Tillage, Seeding and Cultivating Machinery

   A. Maintenance, servicing, adjustment and calibration

   B. Minor repair and replacement of parts

   C. Operation and set-up

AGRICULTURE BUSINESS COMPUTATIONS

Hours Required

Class, 3; Laboratory, 0

Description

This course is intended to prepare the student to handle effectively mathematical problems arising in his career on agricultural chemicals. Review is made of elementary mathematics and study is conducted through advanced arithmetic operations, algebra, and some trigonometry.

The choice of topics and the order in which they are presented integrate mathematics with the technical courses in the curriculum to their mutual benefit. Thus, the basic slide-rule operations are introduced early in the course so that the student can use this tool to advantage in other courses. As the various topics are introduced, the meaning and underlying principles of each and the role each plays in chemical technology should be considered before the subject proper is explored. Practical problems following the exposition of each major topic will help to motivate the student and will strengthen his understanding of the principles involved.

Course Outline

I. Arithmetic Review

   A. Number systems

   B. Fundamental operations

   C. Percentage

   D. Dimensional analysis

II. Basic Slide Rule

   A. Types of slide rules and calculators

   B. Multiplication and division

- C. Powers of ten
- D. Combined multiplication and division
- E. Squaring and square root

III. Fundamental Algebraic Operations

- A. Positive and negative numbers
- B. Review of addition, subtraction, multiplication, and division
- C. Review of factoring
- D. Review of fractions

IV. Equations and Formulas

- A. Meaning and underlying principles of equations
- B. Solving first-degree equations in one unknown
- C. Formula rearrangement and evaluation
- D. Significant figures and approximate computation

V. Applied Problems in Plane and Solid Mensuration

- A. Area and volume of common figures and solids
- B. Relations in triangle, quadrilateral and circle
- C. Applied problems in geometry

VI. Ratio, Proportion, Variation

- A. Meaning of ratio and proportion
- B. Slide-rule solution of proportion problems
- C. Meaning of direct, inverse, and inverse square variations
- D. Technical use of these concepts

VII. Introduction to Trigonometry

- A. Purpose of trigonometry
- B. Definitions of six functions of an acute angle
- C. Trigonometric tables
- D. Solution of right triangles
- E. Applied problems in right triangles

INTRODUCTION TO BIOLOGICAL SCIENCE

Hours Required

Class, 2; Laboratory, 3

Description

A basic course intended to provide a foundation for advanced study needed by technical workers engaged in chemicals technology. Soil fertility, animal and plant nutrition, plant and animal pathology, herbicides, and insecticides are areas of study which require an understanding of biological principles and processes of plants and animals.

Course Outline

I. Basic Biological Principles

   A. Matter and energy

   B. Classification

   C. Organic cycles

   D. Ecology

   E. Diffusion

   F. Pathology

   G. Heredity

   H. Life cycles

   I. Food

   J. Environment

II. Basic Processes

   A. Photosynthesis

- B. Transpiration
- C. Translocation
- D. Irritability
- E. Reproduction
- F. Respiration
- G. Oxidation
- H. Growth and development
- I. Metabolism
- J. Absorption
- K. Digestion
- L. Excretion
- M. Circulation

III. Morphology/Anatomy

- A. Systems
    - 1) Organs
        - a) Parts

IV. Physiology

- A. Structure
- B. Function

SECOND QUARTER COURSES

Communications Skills II
(Writing & Correspondence)

Agricultural Chemistry II
(Organic)

Agricultural Business I
(General Agricultural & Business Economics)

Agricultural Mechanics II
(Agricultural Chemicals Machinery & Equipment)

Introduction to Soils

Introduction to Plant and Animal Entomology

COMMUNICATION SKILLS II

(Writing and Correspondence)

Hours Required

Class, 2; Laboratory, 0

Description

This course is designed to enhance the student's skill in writing, composition, and correspondence. Topics for student reports are chosen from material discussed in their technical courses. The course material correlates and integrates the basic communication skills with vocational and industrial situations instead of treating them as discrete topics. The practical aspect of communication problems dominates the course.

Major Divisions

I. The Idea of Communication; A Point of View (Correspondence and Composition Stressed)

   A. Analysis of the communications process

   B. Examination of the problems involved in the effective use of the basic communication skills

   C. Relationship of language and maladjustment

   D. Dynamics of language

      1) Changes according to time, place, and environment

      2) Levels of usage

      3) View toward grammatical conventions

   E. Meaning and value in words and phrases

II. Investigating and Designing Written Composition

   A. Choosing the subject

   B. Limiting the subject

   C. Determining the purpose

   D. Gathering, selecting, and organizing the material

   E. Examining the forms of discourse: argumentation, description, narration, persuasion

   F. Using aids: dictionary, thesaurus, library, note-taking, outlining

III. Developing the Composition (Written)

   A. Being specific (words, ideas)

      1) Defining terms

      2) The process of definition

      3) Types of meaning -- connotative and denotative

   B. Methods of presentation

   C. Organization

   D. Developing the central idea: forming, stating, supporting

   E. Composing the sentence, the paragraph, the whole composition

IV. Grammatical Convention

   A. Forms, mechanics and usage

   B. Troublesome problems

      1) The sentence fragment and run together sentence

      2) Commonly misspelled words and penmanship

      3) Verb-subject agreement, tense

        4) Paragraphing -- stating and developing a main idea
        5) Punctuation and capitalization

V. Correspondence
    A. Business letters
    B. Social letters

AGRICULTURAL CHEMISTRY II

(Organic Chemistry)

Hours Required

Class, 2; Laboratory, 3

Description

The second chemistry course in the curriculum is designed to provide an understanding of some of the basic laws, concepts, and principles of organic chemistry. This is a systematic study of the compounds of carbon and hydrogen and their substituted products. Applications to the specialized area of agricultural chemicals technology (nutrition, fertility, pesticides, etc.) are stressed.

Course Outline

I. Introduction

    A. Definition of organic chemistry

    B. Reasons for studying the compounds of carbon separately

    C. Marked difference in solubility of organic and inorganic compounds

    D. Reaction rates generally slower, and non-ionic in character

    E. Type reactions -- alcohols to aldehydes, etc.

    F. Complexity of reactions and side reactions

    G. Sources of organic compounds

    H. Electron theories of valence applied to organic compounds

    I. Acylic and cyclic compounds

II. Hydrocarbons
  A. Paraffins
  B. Cycloparaffins
  C. Olefines
  D. Acetylenes
  E. Aromatic hydrocarbons
  F. Hydrocarbon mixtures

III. Alcohols and Phenols
  A. Primary, secondary, and tertiary alcohols
  B. Monohydric and polyhydric alcohols
  C. Preparation
  D. Reactions
  E. Phenols and aromatic alcohols
  F. Uses

IV. Ethers
  A. Nomenclature
  B. Preparation
  C. Reactions
  D. Uses

V. Aldehydes and Ketones
  A. Nomenclature
  B. Preparation
  C. Reactions
  D. Polymerization
  E. Uses

VI. Carboxylic Acids and Their Derivation

- A. Fats, oils, waxes, and detergents
- B. The carboxyl group
- C. Monobasic acids
- D. Polybasic acids
- E. Preparation
- F. Reactions
- G. Uses
- H. Acid Halides
- I. Esters
- J. Anhydrides
- K. Amides and nitrites
- L. Uses

VII. Substituted and Unsaturated Acids, & Amines

- A. Nomenclature
- B. Reactions
- C. Preparation
- D. Aromatic amines and diazotization
- E. Coupling
- F. Sandmeyer reaction
- G. Uses

VIII. Amino Acids, Carbohydrates and Review

- A. Nomenclature
- B. Preparation
- C. Reactions
- D. Uses

AGRICULTURAL BUSINESS I

(General Agriculture Business Economics)

Hours Required

Class, 3; Laboratory, 0

Description

The place of agriculture, farmers, and agricultural businessmen in our economic system; basic economic concepts and economic problems of agriculture and agri-business; agriculture price making and marketing problem; factors of production; and State and Federal programs affecting the farmer's and agricultural businessman's position.

A study of economics designed to impart a basic understanding of the principles of economics and their implications; to develop the ability to follow an informed personal finance program; to aid in the development of intelligent consumption; and to provide an understanding of the underlying relationship of cost control to success in an industrial enterprise. The programs or problems worked upon by an agricultural chemicals technologist ultimately must be measured by a cost analysis. To be aware of this fact, and to have a knowledge of elementary economics, prepares the student for the cost-conscious environment of his future employment. It is suggested that the instruction in this course be based on this pragmatic approach and that students be encouraged to study examples from the chemical industry and agriculture as they learn about cost analysis, competition, creation of demand, economic production, and the related aspects of applied economics.

Course Outline

I. Introduction

A. Basic economic concepts

B. The nature of agriculture business economics

II. Economic Forces and Indicators

   A. Economics defined

   B. Modern specialization

   C. Increasing production and consumption

   D. Measures of economic activity

      1) Gross national product

      2) National income

      3) Disposable personal income

      4) Industrial production

      5) Employment and unemployment

III. Nature of Agriculture Business Economics

   A. Nature of agriculture business

   B. Agricultural resources

   C. Agriculture business prices and price structures

   D. Agriculture business marketing

IV. Capital and Labor

   A. Tools (Capital)

      1) The importance of saving and investment

      2) The necessity for markets

   B. Large-scale enterprise

   C. Labor

      1) Population characteristics

      2) Vocational choice

      3) General education

      4) Special training

      5) Management's role in maintaining labor supply

V. Business Enterprise

  A. Forms, advantages, disadvantages of various business enterprises

    1) Individual proprietorship

    2) Partnership

    3) Corporation

  B. Types of corporate securities

    1) Common stocks

    2) Preferred stocks

    3) Bonds

  C. Mechanics of financing business

  D. Plant organization and management

VI. Factors of Agriculture Business Production

  A. Buidlings and equipment

    1) Initial cost and financing

    2) Repair and maintenance costs

    3) Depreciation and obsolescence costs

  B. Materials

    1) Initial cost and inventory value

    2) Handling and storage costs

  C. Processing and Production

    1) Methods of cost analysis

    2) Cost of labor

    3) Cost of supervision and process control

    4) Effect of losses in percentage of original product compared to finished product

  D. Packaging and shipping

- E. Overhead costs
- F. Taxes
- G. Cost of selling
- H. Process analysis, a means to lower costs
- I. Profitability and business survival

VII. Price, Competition, and Monopoly

- A. Function of prices
- B. Price determination
  - 1) Competitive cost of product
  - 2) Demand
  - 3) Supply
  - 4) Interactions between supply and demand
- C. Competition, benefits, and consequences
  - 1) Monopoly and oligopoly
  - 2) Forces that modify and reduce competition
  - 3) History of government regulation of competition
- D. An analysis of how competitive our economy is

VIII. Government Agencies and Policies

- A. Government programs and policies
- B. Economic effects
- C. Financing governmental spending
- D. Legislation

AGRICULTURAL MECHANICS II

(Chemical Machinery and Equipment)

Hours Required

Class, 1; Laboratory, 3

Description

This course is designed to provide the student with understandings, skills, and abilities needed to properly select, operate, adjust, service, maintain, and repair equipment and machinery which is used to apply agricultural chemicals.

Course Outline

I. Introduction

  A. The importance of proper application - what is the nature of the task to be accomplished?

    1) Ways pests and diseases are controlled, eradicated, or prevented

    2) Ways nutrients and soil additives are applied

  B. Types of chemicals used in agriculture

    1) Insecticides

    2) Fungicides

    3) Nematocides

    4) Herbicides

    5) Plant regulators

    6) Fertilizers

    7) Soil additives

        8) Bactericides
        9) Rodenticides
        10) Molluskocides
    C. Different kinds of chemical materials
        1) Toxic agents
        2) Safeners
        3) Spreaders
        4) Stickers
        5) Wound dressings
        6) Repellants
        7) Baits
        8) Attractants

II. Spraying and Sprayers
    A. Theory and principles of spraying
        1) Effect of speed and pressure on amount applied.
        2) Nozzles and nozzle sizes for proper coverage
        3) Droplet size -- effect of pressure and wind drift
    B. Types of sprayers
    C. Operational principles of sprayers
    D. Parts and construction of sprayers
    E. Maintenance, servicing, cleaning and storage of sprayers
    F. Operating, calibrating, adjusting sprayers
    G. Repair and overhaul of sprayers
    H. Precautions and safety

III. Dusting and Dusting Equipment

- A. Theory and principles of dusting
  - 1) Effect of speed and pressure on amount applied
  - 2) Nozzles and nozzle sizes for proper coverage
  - 3) Particle size-- effect of pressure and wind drift
- B. Types of dusting equipment
- C. Operational principles of dusting equipment
- D. Parts and construction of dusting equipment
- E. Maintenance, servicing, cleaning and storage of dusting equipment
- F. Operating, calibrating, adjusting dusting equipment
- G. Repair and overhaul of dusting equipment
- H. Precautions and safety

IV. Fumigating and Fumigation Equipment

- A. Theory and principles of fumigation equipment
  - 1) Effect of speed and pressure on amount applied
  - 2) Nozzles and nozzle sizes for proper coverage
  - 3) Droplet size -- effect of pressure and wind drift
- B. Types of fumigation equipment
- C. Operational principles of fumigation equipment
- D. Parts and construction of fumigation equipment
- E. Maintenance, servicing, cleaning and storage of fumigation equipment
- F. Operating, calibrating, adjusting fumigation equipment
- G. Repair and overhaul of fumigation equipment
- H. Precautions and safety

V. Fog Applicators

- A. Theory and principles of fog applicators
    - 1) Effect of speed and pressure on amount applied
    - 2) Nozzles and nozzle sizes for proper coverage
    - 3) Droplet size -- effect of pressure and wind drift
- B. Types of fog applicators
- C. Operational principles of fog applicators
- D. Parts and construction of fog applicators
- E. Maintenance, servicing, cleaning and storage of fog applicators
- F. Operating, calibrating, adjusting fog applicators
- G. Repair and overhaul of fog applicators
- H. Precautions and safety

VI. Fertilizer and Soil Additives Equipment

- A. Theory and principles of fertilization and of using soil additives
- B. Equipment for applying solid fertilizers and soil additives
    - 1) Operational principles, maintenance, servicing and cleaning; operating, calibrating and adjusting; repair and overhaul; precautions and safety
- C. Equipment for applying liquid fertilizers and soil additives
    - 1) Operational principles, maintenance, servicing and cleaning; operating, calibrating and adjusting; repair and overhaul; precautions and safety
- D. Equipment for applying gaseous fertilizers and soil additives
    - 1) Operational principles, maintenance, servicing and cleaning; operating, calibrating and adjusting; repair and overhaul; precautions and safety

SOIL SCIENCE I

(Introduction to Soils)

Hours Required

Class, 2; Laboratory, 3

Description

The physical, chemical, and biological properties of soils in relation to plant growth; soil texture, structure, moisture relations, temperature, biological activities and organic matter content. The functions of the soil as a medium to support plant life are stressed.

Course Outline

I. Origin and General Characteristics

  A. Soil formation

    1) Materials of soil formation

    2) Rocks and their composition

    3) Kinds of weathering

    4) Effects of plants and animals - organic matter

  B. Classification and identification

    1) On the basis of parent materials

    2) On the basis of deposition

    3) On the basis of profile development

    4) Storie Index Rating

II. Properties of Soils

  A. Physical

        - 1) Texture
        - 2) Structure
        - 3) Weight
    - B. Chemical
        - 1) Composition
        - 2) Colloidial properties
        - 3) Exchange capacity
        - 4) Soil reaction
    - C. Biological
        - 1) Organisms

III. Organic Matter and Microbiology of the Soil

- A. Organic matter
- B. Microbiology

IV. Interpretation and Use of Soil Maps

V. Soil Moisture

VI. Alkali Saline, and Acid Soils

VII. Introduction to Plant Nutrition and Soil Fertility

VIII. Principles of Soil Management

AGRICULTURAL ENTOMOLOGY

(Introduction to Plant and Animal Entomology)

Hours Required

Class, 2; Laboratory, 3

Description

Classification, identification, life cycle, hosts, habits, and kinds of damage done by insects of importance in agriculture. Principles of insect control, current problems, and trends are introduced.

Course Outline

I. Introduction

A. Definitions

B. Economic importance of insects, damage done by insects

C. Brief history of insect control, explanation of general methods of control

D. Beneficial insects

E. Problems encountered in insect control

II. Classification

A. General

B. Arthropods of importance to man

C. Major orders

III. General Morphology of Insects
   - A. External
   - B. Internal
   - C. Relation to types of damage done

IV. Collection, Identification, and Study of Insects of General Importance

V. Insect Control
   - A. Principles of control
   - B. Biological and cultural
   - C. Natural
   - D. Chemical
   - E. Legal

VI. Types of Damage to Agricultural Crops, Products, and Materials
   - A. Foliar, root, seed, fruit of plants
     - 1) Chewing insects
     - 2) Sucking and piercing insects
     - 3) Lapping insects
     - 4) Irritant insects
   - B. Contamination
   - C. Market appearance

THIRD QUARTER COURSES

Communications Skills III
(Technical Report Writing)

Agricultural Chemistry III
(Agriculture Biochemistry)

Agricultural Business II
(Records and Bookkeeping)

Agricultural Science I
(Basic Agriculture Science)

*The Use of Chemicals as Fertilizers

*The Use of Chemicals as Insecticides (Plants)

*Extended study guides are presented in a subsequent section.

COMMUNICATION SKILLS III

(Technical Report Writing)

Hours Required

Class, 2; Laboratory, 0

Description

A natural and vital extension of Communication Skills intended to help the student achieve greater facility in his use of the language, both spoken and written. Using the basic skills previously acquired, the student is introduced to the practical aspects of organizing information, preparing reports, and communicating within groups. The use of graphs, charts, sketches, diagrams, and drawings to present ideas and clearly significant points is an important part of the course. Emphasis is upon techniques for collecting and presenting technical data by means of informal and formal reports, as well as special types of technical papers. Forms and procedures for technical reports are studied and a pattern is established for all reports to be submitted in this and other courses.

Course Outline

I. Reporting

  A. Nature and types of reports

  B. Objective reporting

  C. Recording of data

  D. Analysis of data

  E. Critical evaluation of a report

II. Writing Technical Reports

  A. The scientific method

B. The techniques of exposition

C. The report form

III. Use of Technical Sketches and Drawings

A. Techniques of freehand sketching

B. Theory of projection

C. Multiview drawing

D. Sectional views

E. Dimensioning of drawings

IV. Use of Diagrammatic Representation

A. Flow diagrams

B. Functional processes

C. Symbols

V. Graphical Presentation of Data

A. Types of graph paper

B. Proper scaling of paper

C. Points and lines -- their meaning

D. Use of data from graphs

VI. The Research Paper

A. Subject and purpose

B. Source materials: bibliographical tools, periodical indexes, the library

C. Organizing the paper

1) A working bibliography

2) Notes and the outline

3) The rough draft

4) Quoting and footnoting

5) The final paper

D. Oral and written presentation of the paper

AGRICULTURAL CHEMISTRY III

(Agricultural Biochemistry)

Hours Required

Class, 2; Laboratory, 3

Description

An introductory study of the chemical processes which occur in plants and animals. Intended as a study to provide technical foundation for understanding the manner in which plants and animals synthesize some of the many chemical constituents of which they are composed; the functions of these constituents; the utilization, alteration or breakdown of these constituents; and general metabolic processes.

Course Outline

- I. Introduction
  - A. Definitions and terminology
  - B. Biochemistry of the cell
  - C. General metabolism in plants and animals
- II. Selected Aspects of Plant Growth
  - A. Plant growth regulation
    - 1) Hormones
  - B. Photosynthesis
  - C. Respiration and plant acids
- III. Selected Aspects of Animal Growth
  - A. Nutrition

- B. Oxidation
- C. Growth regulators
    - 1) Hormones

IV. Role of Different Materials in Metabolism

- A. Nitrogenous compounds
    - 1) Amino acids
    - 2) Proteins
    - 3) Ensymes
    - 4) Alkaloids
    - 5) Nitrification and fixation of N_2
- B. Carbohydrates
- C. Lipids

AGRICULTURAL BUSINESS II

(Accounting and Bookkeeping)

Hours Required

Class, 2; Laboratory, 0

Description

Fundamentals and principles of accounting and bookkeeping with emphasis on business transactions, documents, journals, ledgers, controlling purchases and deliveries, inventory and service control.

Course Outline

I. Fundamentals

    A. Nomenclature and definitions

        1) Assets, liabilities, proprietorship

    B. Principles and procedures

        1) The bookkeeping equation

        2) The balance sheet

        3) The use of accounts

        4) Analyzing business transactions

        5) Journalizing and posting

        6) Trial balance

        7) The work sheet and financial reports

        8) Closing the ledger

II. Cash Items

    A. Making deposits

- B. Cash receipts journal
- C. Cash payment journal
- D. Reconciling bank statements
- E. Petty cash

III. Purchases, Sales, Adjusting and Closing Entries

- A. Handling purchases
- B. Handling sales
- C. Adjusting and closing entries

IV. Additional Records

- A. Taxes and payroll
- B. Notes receivable
- C. Notes payable
- D. Depreciation and bad debt expense
- E. Deferred and accrued items
- F. Closing the books

V. Special Applications

- A. Bookkeeping for small business
- B. The combination journal
- C. Using cash registers
- D. Single entry bookkeeping
- E. Interpreting financial statements

AGRICULTURAL SCIENCE I

(Basic Agriculture Science)

Hours Required

Class, 2; Laboratory, 3

Description

Animal science, plant science, soils and the relationships among the three. Basic principles of plant and animal production; study of the kinds and breeds of livestock and poultry, of the kinds and varieties of crops; their adaptability and an introduction to production practices.

Course Outline

I. Relationship of Soils to Plants and Animals

   A. Function and uses

   B. Interdependence

   C. Cycles

II. General Classifications of Plants

   A. Age

   B. Broad leaf and grass

   C. Legume and non-legume

   D. Field crops

   E. Horticultural crops

III. Varieties of Crop Plants

IV. Principles of Plant Growth

- A. Plant physiology names and functions of plant parts
- B. Pollination and fertilization
- C. Sexual reproduction - seeds
- D. Assexual reproduction - budding, grafting, cutting, layering and division
- E. Parts of seeds - germination

V. Plant Nutrition

- A. Essential elements
- B. Primary nutrients
- C. Secondary nutrients
- D. Trace elements

VI. General Field of Animal Science

- A. Breeding and selection
- B. Feeds, feeding, and nutrition
- C. Sanitation, disease, and parasite control
- D. Management
- E. Marketing
- F. Processing
- G. Distribution

VII. Classification of Animals According to Purity

- A. Registered - include pedigree
- B. Purebred
- C. Crossbred
- D. Grade or commercial
- E. Scrub

VIII. Principle Breeds of Beef, Sheep, Swine, and Dairy

- A. History
- B. Adaptation
- C. Breed characteristics

IX. Nutrients Required by Animals, Their Sources, and Functions

- A. Carbohydrates
- B. Proteins
- C. Vitamins
- D. Minerals
- E. Fat
- F. Feed additives
- G. Others

X. Processing and Distribution of Products

XI. Basic Concepts of the Poultry Industry

- A. Layers
  - 1) Production practices
  - 2) Buildings and equipment
  - 3) Economic factors, rate of lay, cost of production, etc.
- B. Meat birds
  - 1) Production practices
  - 2) Buildings and equipment
  - 3) Economic factors, size of operation, market age and weight, feed conversion, cost of production

FOURTH QUARTER COURSES

Agricultural Science II
(Laboratory Techniques)

Introduction to Plant & Animal Pathology

Agricultural Business III
(Finance, Credit, Budgeting, Taxes)

General Crops Production

Introduction to Weed Science

*The Use of Chemicals as Soil Additives

*Extended study guides are presented in a subsequent section.

AGRICULTURAL SCIENCE II

(Laboratory Techniques)

Hours Required

Class, 1; Laboratory, 3

Description

A laboratory type class designed to develop a high level of competency by the student to perform essential laboratory techniques performed by agricultural chemicals technicians. Basic scientific principles, concepts, and procedures important to the qualification of technical workers are stressed. The objectives of this course extend beyond its immediate purpose of developing understandings and skills associated with laboratory techniques. Not apparent in the outline but of critical importance is the emphasis in both laboratory and lecture upon the scientific method.

Course Outline

I. Basic Measurement
  A. Science and measurement: units of measurement
    1) The scientific method and measurement
    2) Dimensional analysis
    3) Systems of measurement
      a) Traditional: metric and English
      b) Modern: cosmic, atomic, industrial
  B. Methods of measurement
    1) United States and metric standards
    2) Aids to measurement -- vernier, micrometer, planimeter, optional flats, comparators, diffraction grating

II. The Analytical Balance and Weighing

- A. Mass and weight
- B. Construction of balance
- C. Types of balances
- D. Sensitivity
- E. Weighing operations
- F. Care of the balance
- G. Errors in weighing
- H. Weights and their calibration

III. Balances - Non-Analytical

- A. Tri-beam
- B. Pan
- C. Torsion and prescription

IV. The Microscope

- A. Compound
  - 1) Construction, models, and use of
- B. Steroscopic
  - 1) Construction, models, and use of

V. Volumetric Determinations

VI. Density and Specific Gravity

VII. Refractometer

VIII. Separations

- A. Distillation
- B. Soxhlet

C. Moisture

D. Chromatographic

IX. Electrophotometer

X. Meterological Measurements

XI. Determination of Soil Reaction and Lime Requirement

XII. The Extraction and Measurement of Available Phosphorous

XIII. Determination of Available Soil Potassium

XIV. Determination of Available Calcium

XV. Determination of Available Magnesium

XVI. Determination of Soil and Water Salinity

XVII. Estimation of Soil Organic Matter

XVIII. Green Tissue Testing

INTRODUCTION TO PLANT AND ANIMAL PATHOLOGY

Hours Required

Class, 2; Laboratory, 3

Description

Introduction to plant and animal pathology including recognition, symptoms, causes, and effects of common plant and animal diseases. Methods of prevention and control emphasized.

Course Outline

I. Introduction

  A. The battle against plant and animal disease

  B. Economic losses from plant and animal disease

  C. Infectious diseases common to animals, plants, and man

II. Basic Principles of Disease Prevention, Control and Eradication

  A. Causes of disease

    1) Virus

    2) Fungi

    3) Bacteria

    4) Nematodes

    5) Parasites

    6) Insects

  B. How diseases are spread

C. Effect of weather and environment on disease

D. Relationship of soil fertility and animal nutrition on disease

E. Protection against the transmission of disease

F. Inspection and quarantine

G. Methods of prevention and treatment

III. Diseases and Parasites

A. Of animals

1) Symptoms

2) Cause

3) Prevention

4) Treatment

B. Plants

1) Symptoms

2) Cause

3) Prevention

4) Treatment

AGRICULTURAL BUSINESS III

(Finance, Credit, Budgeting, Taxes)

Hours Required

Class, 3; Laboratory, 0

Description

This course is designed to provide the student a basis for understanding the fundamental concepts, principles, and approved practices of those aspects of finance which are an integral part of every family and agricultural business operation.

Course Outline

I. Structure of Modern Agriculture and Capital Requirements

II. Sources of Financial Resources (Short Term, Long Term)

III. Financial Management Principles

IV. Lending Institutions

V. Repayment Schedules

VI. Credit Instruments

VII. Evaluating Resources

VIII. Allocation of Financial Resources

IX. Tax Regulations and Procedures

X. Records and Tax Return

XI. Financial Records

XII. Financial Analysis

XIII. Financial Control

GENERAL CROP PRODUCTION

Hours Required

Class, 2; Laboratory, 3

Description

An introductory crop production course designed to provide an understanding of agronomic principles and local production practices.

Course Outline

I. Historical and Economic Relationships

II. Agronomic, Horticultural, Botanical Classification of Crops

III. Crop Ecology and Effects of Environment

   A. Crop distribution

   B. Length of growing season

   C. Temperature

   D. Light

   E. Moisture

IV. Local Crop Production

   A. Kinds, varieties, adaptations, economic importance

   B. Production practices

      1) Seed bed preparation

      2) Planting

3) Cultivating

4) Fertilization

5) Weed control

6) Insect, disease control

7) Irrigation

8) Harvesting

V. Crop Management

A. Crop selection

B. Calendar of operations

C. Finance

D. Crop rotation

INTRODUCTION TO WEED SCIENCE

Hours Required

Class, 2; Laboratory, 3

Description

A comprehensive study concerned with the identification of important weeds; reproduction and growth of weeds; and methods of controlling weeds. Emphasis is given to the basic principles of controlling undesired plant growth through the use of clean seed, tillage, chemical, and biological means. Examination is made of the influence of interaction of plant species, characteristics, edaphic and climatic conditions, and the characteristics of herbicides as they are related to various control methods.

Course Outline

I. Introduction

A. Definitions and nomenclature

B. Economic importance of weed control, extent and types of damage

C. Problems encountered in controlling weeds

D. History and background of weed control, general methods of control

II. Classification and Identification of Weeds

A. By family characteristics and major orders

B. By economic importance

C. Using identification keys

III. Morphology of Weeds

IV. Collection, Identification, and Study of Weeds of General Importance

V. Control of Weeds

  A. Principles of control

  B. Natural and biological

  C. Cultural

  D. Chemical

VI. Weed Control Services

  A. Research

  B. Surveys

  C. Extension service

  D. USDA

FIFTH QUARTER COURSES

Agricultural Business IV (Selling and Merchandising)

Personal Hygiene, Public Health Education, and First Aid

Agricultural Production Course (Appropriate to the Area)

*The Use of Chemicals as Fungicides, Bactericides, and Nematocides

*The Use of Chemicals in the Area of Field Rodents and Other Predators

*The Use of Chemicals as Herbicides

*Extended study guides are presented in a subsequent section.

AGRICULTURAL BUSINESS IV

(Selling and Merchandising)

Hours Required

Class, 3; Laboratory, 0

Description

A study of the basic principles, concepts, and theories of selling and merchandising with emphasis upon the practical application of these understandings to the fields of agriculture and agri-business, including sales aids, market promotion, and advertising.

Course Outline

I. Importance of Selling and Merchandising

II. Type of Selling

III. Background for Selling

    A. Personal qualifications

    B. The salesman's company

    C. The company promotion program

    D. The salesman's products

    E. Market analysis and customer prospecting

    F. Consumer motivation

    G. The salesman's competition

IV. The Selling Process

- A. Planning the sales story
- B. Getting and opening the interview
- C. Telling the story
- D. Demonstrating and showmanship
- E. Handling objections
- F. Closing the sale
- G. Working with customers
- H. Self-management
- I. Industrial selling
- J. Retail selling

PERSONAL HYGIENE, PUBLIC HEALTH EDUCATION, AND FIRST AID

Hours Required

Class, 2; Laboratory, 0

Description

This course considers the mental, emotional, social, and physical aspects of the student's health; examination is made of community and world health problems; community services and public health agencies are reviewed; and theory and practice of first aid in problems of injury and sudden illness are taught.

Course Outline

I. First Aid

  A. The need for first aid skill

  B. General principles and working knowledge

    1) Fractures

    2) Contusions and wounds

    3) Hemorrhage

    4) Sprains and dislocations

    5) Burns and scalds

    6) Unconsciousness

    7) Antiseptics

    8) Bandaging

    9) Poisons

  C. Safety procedures

II. Personal Hygiene

A. Health education

1) Physical well-being

2) Mental well-being

3) Exercise

4) Foods

5) Eating habits

6) Avoiding infection

7) Care of eyes, ears, nose, throat, teeth, skin

8) Reproduction

9) Narcotics

10) Alcohol

11) Tobacco

III. Public Health Education

A. Important public health problems

1) Community and State

2) World

B. Community services

C. Public health agencies and their programs

SIXTH QUARTER COURSES

Industrial Organizations and Institutions

Agricultural Business V
(Agricultural Business Management)

Personal Development and Human Relations

*The Use of Chemicals in the Areas of Farm Animal Nutrition, Pathology, and Entomology

*The Use of Chemicals as Plant Regulators

*Extended study guides are presented in a subsequent section.

INDUSTRIAL ORGANIZATIONS AND INSTITUTIONS

Hours Required

Class, 3; Laboratory, 0

Description

A description and analysis of the roles played by labor and management in the economy of the United States are presented. Approximately one-half of the classroom time is devoted to labor-management relations, including the evolution and growth of the American labor movement and the development and structure of American business management. A study is made of the legal framework within which labor-management relations are conducted and the responsibilities of each in a democratic system of government. The second half of the course pertains to labor-economics as applied to the forces affecting labor supply and demand, problems of unemployment reduction and control, and wage determination on the national, plant, and individual levels. Emphasis centers upon current practical aspects of our industrial society with historical references intended only as background material to interpret trends and serve as points of departure.

Course Outline

I. Labor in an Industrial World

  A. The nature and scope of the industrial revolution

    1) The factory system

    2) Occupational trends

    3) Mechanisms of adjustment

  B. The evolution of American labor unions

    1) Nature of early unions: basic system of craft unions

    2) Organizations by unions for solving problems

      - 3) Emergence of "business" unionism
      - 4) The changing role of Government
   - C. Structure and objectives of American unions
      - 1) Objectives in collective bargaining
      - 2) Political objectives and tactics
      - 3) Structure of craft and industrial unions
      - 4) Movement toward unity -- the AFL-CIO merger
   - D. The nature of the Agricultural labor force

II. Management in an Industrial Society
   - A. The rise of big business
      - 1) Economic factors
      - 2) Dominance of the corporate firm
      - 3) Government, public policy, and big business
   - B. The "Managerial Revolution"
      - 1) Changing patterns of ownership and management
      - 2) "Scientific" management
      - 3) Twentieth Century trends
   - C. Structure and objectives of American Industry
      - 1) Production for profit: an "Affluent Society"
      - 2) Structure of industry-organizational forms
      - 3) Ethics in a competitive economy

III. The Collective Bargaining Process
   - A. Legal framework
      - 1) Common law provisions
      - 2) The growth of statute laws
         - a) The antitrust laws: aid to emergence of collective bargaining

        - b) The Addamson and LaFollette Laws
        - c) Norris-LaGuardia Act
        - d) Wagner Act
        - e) Taft-Hartley Act
        - f) Landrum-Griffin and beyond
    - B. Management and collective bargaining
    - C. Bargaining procedures and tactics, including conciliation and mediation process
    - D. Issues in collective bargaining
        - 1) Security issues
        - 2) Working conditions
        - 3) Safety provisions and safety education
        - 4) Money matters
    - E. Strikes and lockouts: tactics and prevention
    - F. Evaluation of collective bargaining

- IV. Dynamics of the Labor Market
    - A. Labor supply and the market
        - 1) Level and composition of the labor force
        - 2) Changing patterns of employment
        - 3) Current questions about labor supply and the market
    - B. Reduction and control of unemployment
        - 1) Types of unemployment
        - 2) Proposed schemes of employment stabilization
        - 3) Continuing problems

- C. Labor mobility
  - 1) Types of labor mobility
  - 2) Deterrents to labor mobility
  - 3) Suggested programs to improve labor mobility

V. Wage Determination

- A. Wages, process, and employment
  - 1) Meaning of wages
  - 2) Wages and the productive process
  - 3) The problem of inflation
- B. Wages and the national income
  - 1) Concepts of measurement and productivity
  - 2) Determinants of productivity
  - 3) The distribution of national income
- C. Wage structures
  - 1) Occupational differences
  - 2) Geographic patterns
  - 3) Industry patterns
  - 4) Wage determination: plant level, individual wages

VI. The Balance Sheet of Labor Management Relations

- A. The control and elimination of poverty in a modern industrial State
  - 1) The extent of poverty
  - 2) The attack on poverty
  - 3) Trends and portents
- B. Justice and dignity for all in an industrial democracy
  - 1) The worker -- status and goals
  - 2) Management -- rights and responsibilities
  - 3) The future of capitalistic society

AGRICULTURAL BUSINESS V

(Agricultural Business Management)

Hours Required

Class, 3; Laboratory, 0

Description

A course designed to develop an understanding of the principles and methods related to the effective utilization of human and institutional resources in business organization and management. Managerial planning, business organization, directing the conduct of the business, and evaluation are stressed.

Course Outline

I. Business Ownership, Control, and Management
    A. The functions of management
    B. Management and planning
    C. Organization of the business

II. Managerial Planning
    A. Steps in planning and decision making
    B. Analysis of records and record keeping

III. Economics and Management
    A. Selection of profitable combination of goods and services

IV. Organizing the Business
    A. Departments
    B. Jobs

- C. Organizational structure
- D. Job descriptions
- E. Evaluating performance

V. Managerial Direction
- A. Leadership
- B. Delegation
- C. Responsibility and authority
- D. Professional development of employees

VI. Control and Coordination of the Business
- A. Major areas to be controlled
- B. Setting goals or standards
- C. Reporting by subordinates
- D. Determining alternate solutions to problems
- E. Taking timely action
- F. Effective communications

VII. Budgeting and Resource Allocation
- A. Design of the accounting system
- B. Records available for comparison
- C. Determination of needs
- D. Establishing goals

VIII. Financing the Business
- A. Sources of capital
- B. Expansion and capital needs
- C. Business cycles
- D. Financial planning

IX. Planning Facilities for Increased Efficiency

  A. Determining adequacy of buildings, equipment

  B. Importance of layout and design

  C. Types of construction related to cost, maintenance, and insurance

  D. Depreciation, overhead

X. Merchandising

XI. Improving Customer Relations

XII. Effective Inventory Management

XIII. Customer Service

XIV. Managing Retail Credit

PERSONAL DEVELOPMENT AND HUMAN RELATIONS

Hours Required

Class, 2; Laboratory, 0

Description

Introductory survey of psychological topics, including learning, motivation, emotion, intelligence, personality, and social relations. The elementary concepts and principles of modern psychology with application to everyday living and work are presented. Emphasis is upon human relationships, leadership, and supervision.

Course Outline

I. Introduction

II. Learning and Development

  A. Motivation and attitude

  B. Emotion and feeling

  C. Learning and remembering

  D. Perception

  E. Satisfaction and frustration
  F. Personality and traits of character

III. Human Relations

  A. Social interaction

  B. Social attitudes

  C. Understanding people

  D. Human relation concepts

1) Employer - Employee

2) Supervisor - Employee

3) Employee - other Employees

4) Employee - customers

E. Leadership

IV. Morals and Ethics

A. Definitions and concepts

1) Norms

2) Values

3) Ethics

B. Motivation for ethical behavior

1) Values and goals

2) Peers and colleagues

3) Value-forming institutions

4) Work, careers, occupations

5) Professionalization

6) Association codes

C. Responsibilities

1) Internal relationships

a) Employees

b) Products

2) External relationships

a) Products

b) Services

c) Prices

d) Advertising
e) Selling
f) Competition

g) Personal contacts with others

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APPENDICES

APPENDIX A

GUIDELINES FOR THE DEVELOPMENT OF TRAINING PROGRAMS FOR AGRICULTURAL TECHNICIANS

Section I. Objectives

GUIDELINE: Agricultural technician training program objectives should reflect the unique characteristics of technical education of less than the baccalaureate degree, but above the high school level.

Therefore:

a. The objectives should be such that resulting curricula are primarily occupation-centered and planned toward occupational competence for the graduate.

b. Clearly defined and realistic objectives for the training programs should be developed under the guidance of a professional educator assigned to give leadership in this area.

c. Lay personnel in agricultural businesses and industries should be involved in the development of objectives for agricultural technician training programs.

d. A major objective of the training program should be to prepare the student for immediate productive employment in the technician occupations for which training is provided.

e. The objectives should allow for preparation of students for clusters of related technician occupations.

f. The objectives should be in harmony with the legal bases on which the institution was founded.

g. ____.

Section II. Types of Programs Offered

GUIDELINE: The types of agricultural technician training programs to be offered should be determined with primary but not exclusive attention to occupational (job opportunity), educational and interest surveys of people and industries to be served.

Therefore:

a. An advisory committee including representatives of the agricultural businesses and industries should help carefully plan any surveys made.

    (1) The main purpose to be served by each survey should be determined before instruments for it are developed.

    (2) The precise information desired should be determined and instruments developed to assure its being obtained.

    (3) Sufficient funds and/or time should be budgeted for making the surveys.

    (4) A well-qualified person to direct the survey should be carefully selected.

    (5) The sources of information should be carefully selected.

    (6) Consultant help in field research should be obtained in developing the survey plan and guide.

b. Extensive and dependable information and data are needed, including:

    (1) The identification of jobs or occupational clusters dependent upon agricultural technician training programs.

    (2) The types and number of employment opportunities currently available and those realistically expected over a given period of time.

    (3) The amount of support employers will give to the program.

    (4) Other available sources of education and training for the particular area under consideration.

    (5) The number of potential students who are now interested and would enroll in the program.

c. The survey findings must be carefully analyzed to determine what agricultural technician training curriculums should be established.

    (1) Specialized consultant help should be secured in analyzing and interpreting the survey data.

(2) Advisory committees should be involved in analyzing and interpreting the survey data.

d. ____.

Section III. Curriculum Content

GUIDELINE: Curriculum content for agricultural technician training programs should be closely related to present and future occupational needs.

Therefore:

a. Curriculum content should be primarily occupation-centered.

b. A balance between technical-supporting content and class-laboratory experiences is essential for learning concepts and principles and their application.

c. Preliminary drafts of curriculum content should be developed through a study of the present and future job requirements in the occupational fields selected and the allocation of the required knowledge, skills and understandings to courses of instruction.

d. The depth and scope of mathematics and science must be tailored to occupational needs of those enrolled.

e. The difficulty level should be such that it can be mastered by a reasonably high proportion of the students within the time limits of the curriculum.

f. The curriculum should be flexible enough to be easily revised as needed in advance of the changing competencies of the technician.

g. Curriculum content should be planned with advice, counsel and support of the agricultural industry for which the training program is being developed. Other agricultural education leaders should also be involved.

h. The curricula for the agricultural technician training programs should be coordinated with the total institution program.

i. ____.

Section IV. Recruitment

GUIDELINE: A planned recruitment program should be developed to acquaint prospective students with the opportunities for becoming trained as agricultural technicians and for employment upon successful completion of this training.

Therefore:

a. The recruitment program should include activities with the following groups:

   (1) High school counselors, teachers, and administrators.

   (2) High school students.

   (3) Agricultural industries, businesses, and associations.

   (4) Parents of high school students.

   (5) Other agricultural organizations and agencies.

b. Specific responsibility for giving leadership to recruitment activities should be assigned.

c. Personal contacts with individuals and/or groups of prospective students should be made and maintained.

d. Emphasis in recruitment activities should be based upon fitting the talents and interests of the prospective student to the technician job.

e. Recruiting efforts should clearly show how the training program is essential to securing a job as a technician.

f. ____.

Section V. Student Services

GUIDELINE 1: Selection. Selection of students for agricultural technician training programs should be based on interests, aptitudes, previous education, intellectual capacity and background experience - the criteria varying with the occupations for which training is given.

Therefore:

a. Prospective students should be interviewed and appraised with respect to personal traits, physical handicaps and the like in relation to the job of technician.

b. Policies and procedures for student selection should be carefully developed to assure admission of only qualified students.

c. Only those applicants who have a reasonable chance of success in the training program should be admitted.

d. Self-selection by the prospective student should be a significant part of the selection process.

e. An adequate testing program is important in selection.

f. ____.

GUIDELINE 2: Counseling. Institutions providing agricultural technician training programs should develop an adequate counseling and guidance program, coordinating it with counseling programs of local schools.

Therefore:

a. Counseling services should be made available for the following levels of counseling.

  (1) Counseling prior to enrollment.

  (2) Advisor counseling regarding courses, requirements, study techniques, student organizations, and the like.

b. A trained guidance counselor should be provided to give leadership to and coordinate guidance activities.

c. The counseling and guidance service should provide the following:

  (1) A placement service.

  (2) A vocational information service.

  (3) A follow-up and research service.

  (4) A counseling service.

d. ____.

GUIDELINE 3: Placement and Follow-Up. Placement and follow-up services in agricultural technician training programs should result in graduates being placed in the jobs for which they were prepared and also provide information for proper analysis of program effectiveness.

Therefore:

a. An organized and well-planned placement service should be made available to graduates of agricultural technician training programs.

b. Placement personnel should have extensive contacts with agricultural businesses and industries.

c. Records of employment are essential and should be used for analyzing program effectiveness.

d. Good relationships with prospective employers of graduates should be developed long before actual placements are made.

e. Institutions preparing agricultural technicians should locate desirable placement opportunities for graduates.

f. Up-to-date placement records should be kept for use in public relations, recruitment, and counseling.

g. ____.

GUIDELINE 4: Residence Facilities. Residence facilities should be made available for students enrolled in agricultural technician training programs when sufficient need is demonstrated based on the opportunity of students to obtain programs of their choice which are not available to them otherwise and when the addition of these facilities serves as a means to enable the institution to more fully meet its objectives.

Therefore:

a. The following factors should be considered when determining whether residence facilities should be provided:

   (1) Geographic location of the institution.

   (2) The possibility of placing agricultural technician training in an educational institution within commuting distance.

   (3) The institution's objectives.

   (4) The number of students needing housing.

b. ____.

Section VI. Library

GUIDELINE: Students enrolled in agricultural technician training programs should have ready access to a well-organized, appropriately coordinated library which provides a ready reference to up-to-date information and which has an appropriate range of authentic and professional publications in the area of work for which technicians are being trained.

Therefore:

a. The institution library should be readily accessible for use by students in the agricultural technician training program.

b. The library should be well-equipped with:

    (1) Technical periodicals in agriculture.

    (2) Reference books.

    (3) Technical publications developed by manufacturers of agricultural equipment.

    (4) Pertinent agricultural research bulletins (both publicly and privately sponsored research).

    (5) Pertinent government publications in agriculture.

c. ____.

Section VII. Instructional Staff

GUIDELINE: The instructional staff in agricultural technician training programs should have technical occupational competence in the area for which training is offered and should understand and be proficient in teaching skills and competence essential to successful performance as an agricultural technician.

Therefore:

a. Potential instructors should have adequate backgrounds of technical training, technical experience and appropriate teacher training.

b. An adequate number and variety of instructors should be provided.

c. Adequate funds should be provided to meet the competition of industry for the talents of qualified personnel on the instructional staff.

d. In-service training should be provided for the instructional staff.

e. The agricultural technician teacher:

    (1) Should be able to establish rapport with students.

    (2) Should know how to teach technical subjects.

    (3) Should be proficient in applicable manual skills and the use of tools.

(4) Needs a thorough knowledge of the principles and laws of science and mathematics.

(5) Should be a perpetual student as well as mentor.

f. ______________________________.

Section VIII. Facilities and Equipment

GUIDELINE: Adequate and appropriate facilities and equipment are essential and should be made available in the training of highly competent agricultural technicians.

Therefore:

a. In the planning of all facilities, the objectives of the program should be kept in mind.

b. An adequate number of various types of well-equipped classrooms should be provided.

c. Facilities and equipment should be available for the student to learn to use the precision instruments, the hand and machine tools, materials, processes and operations involved in the technician occupations for which training is given.

d. Equipment lists should be derived from the content of the courses of study which make up the curriculum.

e. Laboratories should be well-equipped for extensive use for testing, research, experiments and so that instruction can be based on the application of a particular science to industrial processes.

f. ______________________________.

Section IX. Acceptance

GUIDELINE: Planned and continuous efforts should be made to increase the acceptance and prestige of technician occupations (including agricultural technicians) and technician training programs.

Therefore:

a. Close and continuous contact with industry is desirable.

b. Counselors, other educators, and parents should be educated to the fact that technician education is not a "second best" education.

c. The institution should develop and maintain good community relations.

d. "Satisfied customers" should be used to increase acceptance of the program.

e. Planned efforts to increase prestige of technician occupations and technician training programs should be made.

f. An associate degree or other appropriate form of recognition should be awarded graduates to increase the status of the program.

g. ____.

Section X. Evaluation

GUIDELINE: Continuous and planned programs of evaluation should be characteristic of agricultural technician training programs.

Therefore:

a. Program evaluation should involve students, graduates of the program, employers of graduates, potential employers, and others.

b. Adequately planning for continuous and comprehensive evaluation is an integral part of program planning.

c. Evaluation procedures should provide for objective evaluation of both the processes and the products of agricultural technician training programs.

d. Evaluation should be concerned with the future as well as the past and present.

e. ____.

Section XI. Accreditation and Licensing

GUIDELINE: Agricultural technician training programs should become accredited and/or licensed as early as possible by a recognized accrediting or licensing agency in order to assure the public that some kinds of recognized standards are being met and to protect graduates from pseudo-technician graduates.

Therefore:

a. Copies of the criteria for accreditation and/or licensing should be secured as early as possible and efforts made to meet them.

b. ____.

Section XII. Location

GUIDELINE: Agricultural technician training programs should be located in institutions in areas of population and agricultural industry and business concentration so as to be readily accessible to those whom they are designed to serve.

Therefore:

a. The program should be located where similar type training is not already offered by other institutions in the area.

b. Location of the program should be made only after a survey of need, interest, and resources is made and evaluated.

c. The institution in which the program is located should lend itself to serving a commuting population of a number of full-time students.

d. The program should be located in an area where students might get first-hand observation of and/or work experience in the cluster of occupations for which the training is being given.

e. ____.

APPENDIX B

THE EDUCATIONAL NEEDS OF AGRICULTURAL CHEMICALS TECHNICIANS

Twenty-three persons, randomly selected from the highly diversified agricultural section of central California, were interviewed in an effort to ascertain the educational needs of technicians who engage in agricultural chemicals work. Inquiry was made regarding the needs of such workers in several subject matter areas: technical agricultural production, general education, agricultural business, personal and human relationships, and work experience education (practical experience).

Responses of Workers in the Agricultural Chemicals Industry Regarding the Educational Needs of Technicians

Subject Matter Area	Number of Different Responses Giving Emphasis
1. AGRICULTURE PRODUCTION Engineering, crops, livestock, soils, irrigation, insects, disease, weeds, plant regulators, soil fertility, plant nutrition, etc.	130
2. GENERAL EDUCATION Math, chemistry, technical writing and reporting, communications, hygiene, first aid, etc.	44
3. AGRICULTURAL-BUSINESS Selling, accounting, labor, finance, economics, management, marketing, etc.	30
4. PERSONAL AND HUMAN RELATIONS Ability to: get along with others, accept responsibility, follow directions, sell oneself; demonstrate pleasing personality, desire, attitude, enthusiasm, etc.	36
5. WORK EXPERIENCE EDUCATION On-the-job training, apprenticeship, practical experience, etc.	20
6. OTHER Safety, laws and regulations, etc.	20

APPENDIX C

THE EDUCATIONAL NEEDS OF AGRICULTURAL CHEMICALS TECHNICIANS

Leaders from twenty-six nationally known agricultural chemical firms submitted responses regarding the educational needs of technicians. A summary of these responses is provided:

1. The greatest shortage of technical workers in the field of agricultural chemicals technology is in the area in which workers engage in activities associated with selling, servicing, merchandising, prescribing, and advising at retail and wholesale levels. The ratio of retail to wholesale workers needed was reported to be about 5 to 1.

   Technical workers are also needed in areas of manufacturing, research, business management, and administration, but still the ratio of the need for workers in all these areas to the need for workers in the area reported in the previous paragraph is approximately 1 to 4.

2. The per cent of responses regarding subject matter areas recommended as being most important for inclusion in a curriculum developed to prepare technical workers in agricultural chemicals technology are:

Subject Matter Area		Per Cent of Responses Recommending Inclusion in Curriculum
a. TECHNICAL SPECIALTY Fertilizers, insecticides, herbicides, plant regulators, fungicides, nematocides, etc.		30
b. SUPPORTING TECHNICAL		50
Plant physiology Physics Chemistry Biological Science Soil fertility Plant nutrition	20	
Agricultural production	15	
Agricultural business	15	

c. GENERAL		
Communications	7	20
Math	7	
Personal and Human Relations	6	

---

3. Most respondents recommended that the type of work experience study program which trainees should engage in during the pre-service training period be one of full-time involvement during the summer months or during a six-month period during the year when demands upon industry are greatest. Only 12% recommended working part time and schooling part time.

4. Institutions developing or conducting training programs can expect industry to participate in a number of ways to support these educational efforts. Some of the ways most frequently mentioned include:

   a. Provide educational materials.

   b. Participate in placement for experience.

   c. Allow limited use of personnel and material resources by training institutions for instructional activities.

   d. Provide resource personnel to work with schools to develop programs and also to assist in the instruction program as needed and invited.

   e. Recommendations submitted in response to the following inquiry varied considerably.

5. The following inquiry (the last of seven) is presented just as it was submitted to the respondents in the study:

   One of the very difficult areas for educators is that which deals with the traits of character, ideals, and value systems of students. Many of our studies have indicated these factors to be of greater importance to the success or failure of employees than any other qualification. On the job, the possession or lack of desirable attributes and standards are reflected and expressed in such things as:

   ability to get along with others,
   ability to take and follow directions,
   interest in the firm and in the job,
   willingness to go the extra mile,
   consideration for others,

initiative,
dependability,
integrity,
leadership and
ambition.

What can be done in educational programs to assure at least a minimal qualification in regard to these important qualities and attributes?

Responses to this inquiry were quite diverse. Two extremes were indicated. (1) There were a number of respondents who indicated that these traits of character and attributes of personality result from complex interactions of many forces in a person's life and are well fixed in students the age normally enrolled in technical training programs. The post-high school can have little influence in the development or changing of most of them. (2) A number of respondents indicated that a considerable amount of teaching and learning is possible in regard to these things at the post-secondary school level and additional effort should be made to provide for organized instruction in such matters. These should be the by-products of a well-balanced training program and schools should certify only those students exhibiting minimum qualification.

Summarization is made of a number of the recommendations submitted:

a. Development of a wholesome attitude toward people and the world of work is critical.

b. Teaching by example is an effective way to develop leadership and enthusiasm in students. The inspiration and guidance offered by teaching by example is often the source and fountainhead of the development of sound judgment, courage to tackle a job, initiative, flexibility, ambition, and dedication and committment as reflected in student behavior.

c. Participation in activities--both curricular and extra curricular, on campus and off, are highly beneficial in the development of self-confidence, leadership ability, platform poise, ease, ability to get along with others, and dependability.

d. Inventories, indexes, and analysis of one's personal attributes and traits of character are matters for professional psychologists and persons trained in such fields should direct efforts to change behavioral patterns of persons at the age levels of concern in this area.

APPENDIX D

Evaluations of degree competencies in agriculture were needed and possessed by males employed in retail fertilizer distribution businesses --**Mean Scores

Competencies	Managers (N=94)		Sales (N=44)		Service (N=43)	
	Needed	Possessed	Needed	Possessed	Needed	Possessed
UNDERSTANDING OF:						
Fertilizer plant operation	3.5	3.3	2.8	2.6	3.3	3.1
Farm Credit procedures	3.5	3.0	2.8	2.3	2.7	2.2
Governmental agricultural programs and their effect on fertilizer use	3.0	2.6	2.5	2.0	2.7	2.0
Characteristics of different fertilizer materials before and after they are blended	3.4	3.1	2.9	2.5	3.2	2.8
Physical and chemical properties of soil in relation to plant growth and yield potential	3.1	2.5	2.9	2.0	3.0	2.1
Cropping plans for specific soil types	3.0	2.4	2.8	2.3	2.7	2.1
Timeliness of operations in relation to crop yields	3.2	2.8	2.7	2.5	2.9	2.7
ABILITY TO:						
Take an accurate soil sample	3.2	3.1	3.3	3.0	2.9	2.7
Interpret a soil test report	3.6	3.2	3.4	3.1	3.0	2.6
Identify various fertilizer materials and evaluate fertilizer formulas	3.5	3.2	3.3	2.8	3.2	2.8

	Managers (N=94)		Sales (N=44)		Service (N=43)	
	Needed	Possessed	Needed	Possessed	Needed	Possessed
Make recommendations to customers regarding proper use of fertilizers and assist customer in keeping a fertilization history on his farm	3.5	3.2	3.4	3.0	3.0	2.5
Recognize good new fertilizer practices and recommend their use	3.5	3.1	3.4	2.8	3.1	2.7
Recognize plant food deficiency in growing crops	3.4	2.7	3.5	2.4	3.0	2.4
Help tenant sell his landlord on a sound fertilizer program	3.1	2.7	3.0	2.4	2.9	2.4
Operate and maintain fertilizer handling equipment	3.0	2.9	2.9	2.6	3.3	3.1
Determine proper tillage conditions for application of fertilizers	3.1	2.7	3.0	2.4	2.8	2.6

**The following five-point rating scale was used by the respondents in evaluating the degree of competence that was needed and that was possessed for each of the competencies listed: 4--very much, 3--much, 2--some, 1--little, and 0--none.

THE CENTER FOR RESEARCH AND LEADERSHIP DEVELOPMENT
IN VOCATIONAL AND TECHNICAL EDUCATION
THE OHIO STATE UNIVERSITY
980 KINNEAR ROAD
COLUMBUS, OHIO, 43212

INSTRUCTOR NOTE: As soon as you have completed teaching each module, please record your reaction on this form and return to the above address.

1. Instructor's Name____

2. Name of school__________________________State_______________

3. Course outline used: _____Agriculture Supply--Sales and Service Occupations
_____Ornamental Horticulture--Service Occupations
_____Agricultural Machinery--Service Occupations

4. Name of module evaluated in this report____________________________

5. To what group (age and/or class description) was this material presented?____
____

6. How many students:
   a) Were enrolled in class (total) ________
   b) Participated in studying this module ________
   c) Participated in a related occupational work experience program while you taught this module ________

7. Actual time spent teaching module:

Actual time spent teaching module:		Recommended time if you were to teach the module again:
_____hours	Classroom Instruction	_____hours
_____hours	Laboratory Experience	_____hours
_____hours	Occupational Experience (Average time for each student participating)	_____hours
_____hours	Total time	_____hours

(RESPOND TO THE FOLLOWING STATEMENTS WITH A CHECK (✓) ALONG THE LINE TO INDICATE YOUR BEST ESTIMATE.)

	VERY APPROPRIATE				NOT APPROPRIATE
8. The suggested time allotments given with this module were:	|	.	.	.	. |
9. The suggestions for introducing this module were:	|	.	.	.	. |
10. The suggested competencies to be developed were:	|	.	.	.	. |
11. For your particular class situation, the level of subject matter content was:	|	.	.	.	. |
12. The Suggested Teaching-Learning Activities were:	|	.	.	.	. |
13. The Suggested Instructional Materials and References were:	|	.	.	.	. |
14. The Suggested Occupational Experiences were:	|	.	.	.	. |

(OVER)

15. Was the subject matter content sufficiently detailed to enable you to develop the desired degree of competency in the student? Yes_____No_____
Comments:

16. Was the subject matter content directly related to the type of occupational experience the student received? Yes_____No_____
Comments:

17. List any subject matter items which should be added or deleted:

18. List any additional instructional materials and references which you used or think appropriate:

19. List any additional Teaching-Learning Activities which you feel were particularly successful:

20. List any additional Occupational Work Experiences you used or feel appropriate:

21. What do you see as the major strength of this module?

22. What do you see as the major weakness of this module?

23. Other comments concerning this module:

______________________ ____
(Date) (Instructor's Signature)

____
(School Address)